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A DIGITAL SIMULATION MODEL OF MESSAGE HANDLING IN THE TACTICAL OPERATIONS SYSTEM

V. User's Guide to the Integrated MANMOD/CASE/SAMTOS Computer Simulation

W. Rick Leahy, Arthur L. Siegel, J. Jay Wolf
Applied Psychological Services, Inc.

HUMAN FACTORS TECHNICAL AREA

U. S. Army
Research Institute for the Behavioral and Social Sciences

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This document is a complete guide for the use and interpretation of the computer simulation program--MANMOD. The program is stored in files on the Univac 1108 computer at the Edgewood Arsenal. The MANMOD program calls the Army Research Institute's MANMOD simulation of the Tactical Operations System and provides an interface with the CASE and the SAMTOS computer simulation models.

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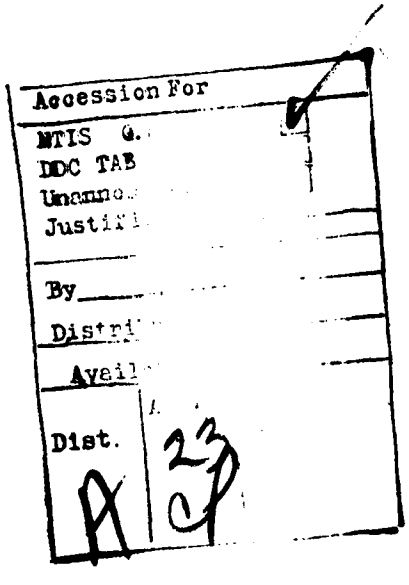
The MANMOD program is written in FORTRAN IV. Sufficient information is provided in this manual to allow simulations to be performed by individuals with minimum computer related experience. In addition, detailed flow charts and variable lists are provided for the use of skilled programmers who desire a more technical description of the mechanics of the simulation and to allow program changes to be made more easily.



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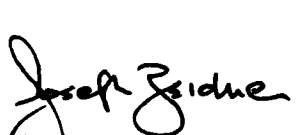
FOREWORD

The Human Factors Technical Area of the Army Research Institute (ARI) is concerned with the human resource demands of increasingly complex battlefield systems designed to acquire, transmit, process, disseminate, and utilize information. Research focuses on human performance problems related to interactions within command-and-control centers as well as issues of system development, performance, effectiveness, and efficiency. It is concerned with such areas as software development, topographic products and procedures, tactical symbology, user-oriented systems, information management, staff operations and procedures, decision support, and sensor systems integration and utilization.

Of special interest are the human factors problems related to the integration of human functions into information-processing systems and to the harmonizing of system components, personnel, and operations in a battlefield environment. To incorporate human functions and performance into simulated system operations, a research program at ARI developed a computer simulation of a generalized human information processing model (MANMOD). MANMOD permits study of system operations and performance under prescribed as well as alternative personnel and equipment configurations.

This user's guide is a companion to ARI Technical Report 413 (Volume IV), which describes the interface of MANMOD with two computer models, CASE and SAMTOS, of the Army's tactical operations system (TOS). It documents the MANMOD computer model in sufficient detail to permit on-line simulation by users with minimal computer experience and to facilitate program changes by skilled programmers. This effort supported the Army's cost-effectiveness analysis of TOS (CEATOS) and the investigation of alternative TOS configurations. Earlier reports in the series described sequential versions of MANMOD: batch processing in Volume I (ARI technical report TR-77-A23), on-line processing in Volume II (TR-77-A24), and interactive in Volume III (TR-77-A25). Also, ARI publications TR-77-A22 and Technical Report 407 describe a second-generation model, NETMAN, developed on the basis of MANMOD research.

Research on systems integration and operations is conducted as an in-house effort augmented through contracts with organizations selected for their unique capabilities and facilities for research and development on human performance and computer simulation. This report represents research by personnel from ARI and Applied Psychological Services, Inc., under contract DAHC19-75-C-0001. The effort is responsive to general requirements of Army Project 2Q762722A765 and to special requirements of the U.S. Army Combined Arms Combat Development Activity. Special requirements are contained in Human Resources Need 76-161, "MAN MODEL interface with other CEATOS support models."



JOSEPH ZEIDNER
Technical Director

A DIGITAL SIMULATION MODEL OF MESSAGE HANDLING IN THE TACTICAL OPERATIONS SYSTEM: V. User's Guide to the Integrated MANMOD/CASE/SAMTOS Computer Simulation

BRIEF

Requirement:

To develop a user's manual and programmer's guide to the integrated MANMOD/CASE/SAMTOS simulation of the Army's tactical operations system (TOS). MANMOD simulates activities within a communications station and assesses the effects of operator characteristics on message-handling performance to provide estimates of human performance parameters. CASE simulates the TOS communications network itself and estimates the effects on TOS performance of number of components and network variations. SAMTOS simulates the TOS computer hardware and software.

Product:

In the integrated simulation, MANMOD accepts network equipment parameter estimates from CASE and generates estimates of human performance parameters for use in the SAMTOS model. This user's guide documents input specifications of simulation parameters, operation and output options, and interpretation of the output data. A program listing and detailed flow charts are provided to facilitate program changes.

Utilization:

The documentation permits users and programmers to modify the integrated MANMOD/CASE/SAMTOS program to satisfy a larger variety of system simulation requirements. The integration of the three computer simulations provides a useful tool for analyzing and designing alternative system configurations. Within the limits imposed by the lack of appropriate data for validating the model, system effectiveness and other figures of merit can be obtained for alternative system configurations. These alternatives can reflect differences in personnel characteristics, manning levels, message traffic loads, equipment capabilities, performance, or message types. Results can provide insights on equipment design, training and personnel requirements, and the tradeoffs necessary for optimum cost effectiveness.

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CHAPTER I

INTRODUCTION

Background

Under the sponsorship of the U. S. Army Research Institute for the Behavioral and Social Sciences, in 1971 Applied Psychological Services developed a computer simulation of the U. S. Army's Tactical Operations System (Siegel, Wolf, & Leahy, 1973a). In this model, the psychological factors and the queuing structure of message preparation and transmission at the G3 level are simulated. The MANMOD was set up originally for data card input. Later (Siegel, Wolf, Leahy, & Bearde, 1973b) this capability was extended to allow the model user to change the input data via a terminal and to view summary statistics on the terminal cathode ray tube display. This new capability was considered to increasely greatly the flexibility and utility of the MANMOD and thereby allow increased use. A third effort was completed (Leahy, Lautman, Wolf, Bearde, & Siegel, 1974) to allow the real time collection of experimental data (i. e., allowing an online operator to perform part of the message handling task) with subsequent automatic data reduction and incorporation into a fully automatic simulation. The procedure for the completion of performing such subject interactive simulations is reported in A Digital Simulation Model of Message Handling in the Tactical Operations System. III. Further Extensions of the Model for Increased Interaction.

In the current effort, the MANMOD was coupled with the CASE and the SAMTOS models. The advantages of such integration are found in the body of the report titled A Digital Simulation Model of Message Handling in the Tactical Operations System. IV. Model Integration with CASE and SAMTOS to which the present user's manual forms an appendix. In performing the integration, the subject interactive feature was not included because the coupled models are exercised on the U 1108 high speed digital computer system which in the anticipated mode of use will be time shared. Use of a time sharing system prevents a realistic subject/computer interaction.

The "user's manual" presents the information required for employing the integrated model. As such, it also represents a full users manual for MANMOD since MANMOD is the core of the integration.

The manual contains full input data instructions, operating instructions, and out descriptions. A full glossary along with program list and flow charts are included as appendices.

CHAPTER II

INPUT DATA

The required input data for specifying the simulation structure for the integrated models are described in this section. Required, optional, and default parameters are delineated, along with a brief rationale concerning the relative impact of parameter changes on the simulation validity and on the computer time usage. Three different systems of input data are used in the model and will be described in this section. There are card input, CRT input, and computer data file input.

Card Input

Table 2-1 presents the sequence of data cards for entering the MANMOD computer program. There is a total of 29 card types. Six types are control cards which either initiate or bypass the entry of different types of data. These control cards allow default options to be used for simplicity and also allow the capability of making slightly different multiple runs back to back without the need to repeat the input of all of the data. The final data card triggers either a simulation termination or a return to card type 1 and a new simulation. The order of data cards within a run is critical. A single card type out of sequence, an extra card, or a missing card will cause either an aborted run or a meaningless output.

Table 2-2 identifies variable name, variable usage and purpose, card columns, and input format for card types 1 and 2. The variable names are the FORTRAN names used in the computer program. The descriptions are an abstracted version of the text. The card columns identify the computer card columns to be used on the specified card allocated for the variable. For example, in Table 2-2, the variable NSHIFT is shown to occur on card type 2 in card columns 1 to 3. This means the longest value which could be specified is 999. The letter I in the format columns says that the variable is entered in an integer format and no decimal point is required and, in fact, is not allowed. The number entered in these columns is right justified where blanks are read as zeros. That is, a 9 in column one followed by two blanks will be read in as 900. An A under format identifies alphanumeric data where the exact contents of the columns are recorded for later printing. An R under format identifies a real variable. A real number requires a decimal point.

Table 2-1

Input Card Sequence

Order (and Type)	Description of Input Card Contents/Function
1	Mission title
2	Simulation parameters
3	Option card
4	Names of operators
5	Operation parameters (one card per operator)
6	Option card
7	Names of message types
8	Hour parameters (one card for each hour)
9	Option card
10	Error data (one card for each of three error types)
11	Option card
12	Message length data
13	Message length standard deviation data
14	Option card
15	Task analysis data (one card for every task element)
16	Option card
17	Effectiveness components
18	Number of error messages
19	Error message VCG data (one card for every error message)
20	Number of information search options
21	Information search data (one card for every information search option)
22	Option card
23	Correction submission data
24	Option card
25	Random walk data
26	Option card
27	Levels of ambiguity data
28	Interruption data and message transmission data
29	Option card

Table 2-2

Input--Mission Identification and Simulation Parameters

		Card Columns	Format
Mission Title (card type 1)			
IDENT-	A run descriptor of up to 72 characters is printed on the top of each page of printout followed by the page number	1-72	A
Simulation Parameters (card type 2)			
NSHIFT-	Number of repetitions or iterations of this mission before summary data are prepared	1-3	I
IHMAX-	Number of hours per shift (determines the number of type 6 cards to be read)	4-5	I
MEN(1)-	Number of operators of type 1, number of action officers including G-3. The highest numbered AO is the G-3	6	I
MEN(2)-	Number of operators of type 2, number of input/output device (IOD) operators. The sum of MEN(1) + MEN(2) determines the number of type 5 cards to be read in	7	I
NERROP-	Option to process error messages. If equals 1 error message data will be read in	8	I
INTOP-	Option to input interruption and transmission delay data	9	I
ORO(1)-	Output recording option number 1. If equal 1 print input data	10	A
ORO(2)-	Ouput recording option number 2. If equal to 1 print hourly message queue	11	A
ORO(3)-	Not used	12	A
ORO(4)-	Output recording option 4. If equal to 1 print detail task element processing	13	A
ORO(5)-	Output recording option 5. If equal to 1 print message processing	14	A
ORO(6)-	Output recording option 6. If equal to 1 print hour and iteration summary	15	A
ORO(7)-	If equal to 1 allows experimenter change of input data	16	A
ORO(8)-	If equal to 1 triggers personal interruption data input	17	A
ORO(9)-	If equal to 1 calls data from CASE	18	A
IDAY-	Day of mission simulation	19-20	I
BKLG-	Number of messages in AO/G3 inbox at the beginning of the shift	21-22	I
PUL-	Probability of a non important undetected error in the central computer complex data store	25-29	R
PUS-	Probability of a significant error in the central computer complex data store	30-34	R
SRTA-	System response time to an inquiry	35-39	R
SRTS-	Standard deviation of the system response time to an inquiry	40-44	R
IATA(1,1)	Task analysis to be used for operator type 1 message type 1	45	I
IATA(1,2)	Same as above but for message type 2	46	I
IATA(1,3)	Same as above but for message type 3	47	I
IATA(1,4)	Same as above but for message type 4	48	I
IATA(1,5)	Same as above but for message type 5	49	I
IATA(1,6)	Same as above but for message type 6	50	I
IATA(1,7)	Same as above but for message type 7	51	I
IATA(1,8)	Same as above but for message type 8	52	I
IATA(2,1)	Operator type 2, message type 1	53	I
IATA(2,2)	Operator type 2, message type 2	54	I
IATA(2,3)	Operator type 2, message type 3	55	I
IATA(2,4)	Operator type 2, message type 4	56	I
IATA(2,5)	Operator type 2, message type 5	57	I
IATA(2,6)	Operator type 2, message type 6	58	I
IATA(2,7)	Operator type 2, message type 7	59	I
IATA(2,8)	Operator type 2, message type 8	60	I
NTE-	Number of task elements overall task analyses to be used (determines the number of type 15 cards to be read in)	61-63	I
Y-	Random number to be used to initialize random number generator (must be odd number greater than 1)	65-71	R
ICHAIN-	Shift number for this run if chaining option is being utilized (ICHAIN= 1 first shift, 0 if no chaining)	76	I
TZERO-	Time at start of shift being simulated	77-80	R

Card Type 1

Card type 1 is the first data card. It must be the first entry in the data file if the cards are read into a file before use in a simulation. The formats for card types 1 and 2 are shown in Table 2-2. Card type 1 provides 72 columns (columns 1 through 72 on a computer card) for a prose description of the mission to be simulated. This prose description is stored in a variable array dimensioned at 12 (6 alphanumeric characters may be stored in each word on the U 1108 computer). The purpose of this title is to allow easy identification of a run. The title is printed at the top of each page of computer printout produced during the simulation.

Card Type 2

Card type 2 contains the more general simulation parameters to be used to control the simulation. The first variable on this card sets the number of times the entire simulated mission will be repeated (NSHIFT). The results of the simulation will be averaged across all NSHIFT mission repetitions to produce the output data. This repetition is necessary due to the stochastic nature of many simulation aspects. Only after the repetition of the mission across a sufficient number of stochastically generated combinations of events can a more or less stabilized pattern of output be produced. When a totally new mission is under analysis, a comparison of the differences in the results between 10, 20, 50, and 100 iterations is advisable. A difference between the results of only a few per cent is sufficient for selecting the smaller number of iterations for further runs. Naturally, the smallest number of iterations producing a stable output pattern should be selected because the number of iterations is the primary determinant of computer processing time.

The second card type 2 variable is the number of hours to be simulated (IHMAX). Up to 12 hours may be simulated during a shift. The value of this variable will determine the number of type 8 cards read, although the type 6 card will determine if any are read in on a given run. This allows multiple simulations. For example, where 12 hours are simulated in one run, only the first six hours of the 12 might be simulated in a second run. Obviously, more hours may not be simulated on a second run without reading in a new complete set of hour data.

The next variables entered are the number of Action Officers [MEN(1)] and the number of input/output device operators [MEN(2)] to be included in the simulation. At least one of each must be specified. The number of Action Officers includes the G3, who only works on non routine messages. The total number of men [MEN(1)+ MEN(2)] may not exceed six.

Variable NERROP of card type 2 determines whether the error message evaluation aspect of the MANMOD will be used in the current run. If the value 1 is entered, then the data cards type 18 to 27 (described later) must be supplied. If any other value is used, error messages occurring in the simulation cause a simple branch in the task analysis and no simulation of the decision process or the information search procedure will occur.

Another option controller is the variable INTOP. If INTOP is set equal to 1, the incoming message interruption and transmission delay features will be used. Exercising this option requires that card type 28 be supplied.

Five output recording options [ORO(1-6)] are available for selection. Samples of each printout option are presented and discussed in Chapter III. These options are triggered by a 1 in the appropriate column. Option 1 provides a printout record of the input data in its entirety. Option 2 provides a printout of the Action Officer message queue which includes the messages already available, as well as the messages which will be arriving during the hour. The IOD queue is also displayed as a result of option 2. Option 3 is not used. Option 4 provides the most detailed record of the simulation including the time and outcome of all tasks performed. This record will produce two pages of printout for each message processed, not counting hour iteration summaries. The program will automatically drop detailed printing after the first iteration. Option 5 produces a printout of message processing information including any errors and the time at which the message completion segments were performed. Option 6 produces hour and iteration summaries. The overall run and shift summaries are automatically called at the appropriate times and thus are not optional.

Options 7, 8, and 9 are not printout options but interaction options. Option 7, when exercised, allows the user to change output via a terminal, as well as to receive summary data on the terminal's cathode ray tube.

Option 8 calls data collected in the subject interactive mode. The subject interactive data collection mode is not currently available on the U 1108 system. However, provision for the use of data collected in this mode has been included if such capability becomes available in the future.

Option 9 allows for entering data provided by the CASE model. This option also enters output data into another file for the later use of the SAMTOS model. These data are described later. The next variable entered is the day of the mission simulated. The day number refers to the number of days which have been worked without a day off up to and including the simulated day. The day number is used as a partial basis for computing operator fatigue level.

The number of messages in the Action Officer's in box (BKLG) at the beginning of the shift is the next variable entered. These represent backlog messages or communications left over from the previous shift. This number is replaced by a simulation generated number for the second shift of a chained run.

The probability of an unimportant undetected error (PUL) is followed by the probability of a significant error (PUS) in the central computer complex. These errors represent noncorrected data which will compose misinformation within the data bank. These probabilities are used in connection with other simulated performance characteristics to predict information loss and other measures of system performance.

The average response time (the time between an inquiry and a response) (SRTA) is entered along with its standard deviation (SRTS). These values may be replaced by CASE generated data if option 9, described above, is exercised.

The IATA (J, IT) array identifies the task analysis or procedure to be used by each operator type (J) in processing each type of message (IT). The exact task analysis data are entered later. The model is presently limited to a maximum of four task analyses. A task analysis may have up to 20 task elements. The total number of task elements (NTE) across all task analyses is entered. This value will determine the number of type 15 cards to be entered later. This value will be overridden by the type 14 and if no cards are to be read in on a particular run.

The random number generator must be initiated by starter value (Y). The starter value will produce a repeatable string of pseudorandom numbers. By using the same initial value of Y, along with an identical set of input data, an exact simulation duplicate can be produced. This capability is useful when a repetition of a specific run is wanted.

A simulation may be run chaining the messages left incomplete on one run to the backlog used on the next run. This chaining option is controlled by the variable ICHAIN. Where no chaining is desired, ICHAIN should be set to zero. When ICHAIN is set to one, the left over messages are recorded onto a data file. When ICHAIN is set to 2, the number of incompleted messages from run 1 are considered as backlog messages and are processed. The time in seconds at the start of the shift being simulated (TZERO) represents the final card type 2 entry.

Card Types 3, 4, and 5

Table 2-3 presents the operator performance parameters entered on card type 3. Column 1 of card type 3 (ISKIP), if set to 1, will cause the program to skip the section on entering operator parameters. Like the other skip commands in this section, this skip courses a bypassing of the computer program sections which read in the relevant data. That is, if the skip instruction is given but data cards containing operator characteristics are entered, the program will fail.

The first card (card type 4) after the ISKIP card contains the name or other alphanumeric identifiers of each of the operators being simulated. As shown in Table 2-3, the names (NAME) are read from 1 to N, where N is the total number of operators in the system [(N = MEN(1) + MEN(2)]. Six card columns are allocated for each name and as many groups of 6 will be read as necessary. These names will be shown on various printouts produced by the simulation and afford interpretive ease.

The operator performance characteristics are entered through card type 5. One card type 5 is employed for each operator. The first column of each card type 5 contains the man number (M). The operator speed entry [(F(M)] indicates how fast this crewman works in comparison with the average speed specified in the time allocations on the task analysis cards. An average man should be assigned an F(M) factor of 1.0. As the F(M) values decrease, the speed of the simulated operator increases. A speed factor of .80 would indicate a rapid worker. Similarly, a speed factor of 1.2 would produce a slower than average worker. Extreme values of less than .5 or more than 1.5 are not recommended as they represent individuals who are grossly atypical. This speed factor is considered independently of the accuracy of work. Operator precision or accuracy is indicated by another factor [PREC(M)]. This precision factor is scaled similarly to speed. That is, a highly precise man (i.e., one who makes fewer errors than the average would have a precision factor of less than 1.0). A perfect operator (never any errors or task element failures) would be represented by a value of .8 and a value of 1.2 would result in a grossly incompetent operator.

Stress is produced within the model when nonroutine messages accumulate up in the inbox. Within the model, stress serves to produce faster and more accurate work up to a preset threshold [STRM(M)]. This stress threshold is equivalent to the number of priority messages waiting in the inbox which will produce a maximum effort for this man.

The final card type 5 entry represents the man's level of aspiration [ASP(M)]. An entry of 1.0 means that this man strives for perfection. Aspiration levels of .90 to .95 have been found to be appropriate in most simulation situations.

Table 2-3

Input--Operator Parameters

	Card Columns	Format
Read or skip operator parameters (card type 3)		
ISKIP- If equal to 1 skip to reading card type 6. If not equal to 1 read card types 4 and 5.....	1	I
Names of operators (card type 4). Reads in one six character name for each of the men specified in card type 2.		
NAME(1)- Name of operator number 1.....	1-6	A
NAME(2)- Name of operator 2.....	7-12	A
NAME(M)- Name of operator M		
Operator parameters (card type 5). One card is read in for each man specified in card type 2.		
M- Man number.....	1	I
F(M)- The speed factor of this man. A faster than average man has an F(M) value less than 1.0. A slower than average man has an F(M) value greater than 1.0.....	5-9	R
PREC(M)- The precision factor of this man. An average man who makes an average number of errors would have a precision factor of 1.0. A highly precise man who makes many fewer than average errors would have a precision factor of 0.9. Perfection is represented by a value of 0.8 and complete failure which would result in unending runs is represented by a value of 1.2.....	10-14	R
STRM(M)- The stress threshold of this man. The number of priority messages in the backlog for this man will produce a maximum effort.....	15-19	R
ASP(M)- The level of aspiration of this man. An aspiration of 1.0 represents striving for perfection.....	20-24	R

Card Types 6, 7, 8, and 7.5

Table 2-4 presents the hour parameter input information contained on card types 6, 7, 8, and 7.5. Card type 6 allows the option to skip the input of the data called for by card types 7, 8, and 7.5. A 1 in column 1 causes a transfer to reading in the data contained in card type 9. Anything else in this column (as long as it is an integer number) will permit normal input processing.

In card type 7, a six digit alphanumeric identifier is read in for each message type (NMTYP). This identifier will be printed out in the detail record (when this output option is called). It identifies the type of message being processed at any given time.

One type 8 card is involved for each hour specified on the type 2 card, INMAX entry. The first datum on each type 8 card is the hour number (IH). Then, the number of messages which will arrive in the Action Officer's inbox in the final 15 minutes of this hour is indicated [IGP(IH)]. The number of messages arriving in the Action Officer's inbox randomly throughout the hour [IGR(IH)] is the next entry. Messages specified in this category may still, by chance, arrive in the last quarter of the hour. The next value [IUR(IH)] is presently nonfunctional.

Although the number of messages arriving during the hour is fixed [IGP(IH)] + IGR(IH)], the priority and the type of each individual message within an iteration is stochastically determined. The probability that any given message type is assigned is specified by the variable FRET(IT, IH). The probabilities are entered cumulatively as IT goes from 1 to 7. For example, if .70, .78, .82, and 1.0 are entered, type 1 has a probability of .70, type 2 has a probability of .08, etc. The final proportion must be equal to 1.0 within an hour. This method allows one random number to be drawn from a uniform distribution (i.e., uniform between 0.0 and 1.0). This one random number is compared with the type probabilities as IT goes from 1 to IT. If the random number .74 was selected, it would be compared with .7 and type 1 would be rejected; then .74 would be compared with type 2, and since its cumulative probability of .78 is greater than .74, message type 2 would be selected.

Message priority is also selected stochastically. The variable FREP(IP, IH) specifies the cumulative probability of each message priority (IP) within each hour (IH). The input form is the same as for FRET, described above.

Table 2-1

Input--Hour Parameters

	Card Columns	Format
Read or skip hour parameters (card type 6)		
ISKIP- If equal to 1 skip card type 9 If not equal to 1, read card types 7 and 8	1	I
Names of message types (card type 7)		
NMTYP(1)-Name of message type 1	1-6	A
NMTYP(2)-Name of message type 2	7-12	A
NMTYP(3)-Name of message type 3	13-18	A
NMTYP(4)-Name of message type 4	19-24	A
NMTYP(5)-Name of message type 5	25-30	A
NMTYP(6)-Name of message type 6	31-36	A
NMTYP(7)-Name of message type 7	37-42	A
Messages per stimulus data (card type 7.5)		
RMPS(1)-Number of messages expected per stimulus for message type 1	1-5	R
RMPS(2)-Number of messages expected per stimulus for message type 2	6-10	R
RPMS(3)-Number of messages expected per stimulus for message type 3	11-15	R
RPMS(4)-Number of messages expected per stimulus for message type 4	16-20	R
RPMS(5)-Number of messages expected per stimulus for message type 5	21-25	R
RPMS(6)-Number of messages expected per stimulus for message type 6	26-30	R
RPMS(7)-Number of messages expected per stimulus for message type 7	31-35	R
Hour parameters (card type 8) One card for each hour specified in card type 2 by IHMAX.		
IH-Hour number	1-2	I
IGP(IH)-Number of messages arriving in AO/G3's inbox in the last 15 minutes of this hour	3-4	I
IGR(IH)-Number of messages arriving in AO/G3's inbox randomly throughout this hour	5-6	I
IUR(IH)-Non functional	7-8	I
FRET(1,IH)-Cumulative proportional occurrence of message type 1 -add	10-14	R
FRET(2,IH)-Type 2-change	15-19	R
FRET(3,IH)-Type 3-delete	20-24	R
FRET(4,IH)-Type 4-query	25-29	R
FRET(5,IH)-Type 5-relay	30-34	R
FRET(6,IH)-Type 6-SPR	35-39	R
FRET(7,IH)-Type 7-SRI	40-44	R
FREP(1,IH)-Cumulative proportion of message occurrence of priority type 1 - routine	45-49	R
FREP(2,IH)-Priority type 2-priority	50-54	R
FREP(3,IH)-Priority type 3-operational immediate	55-59	R
FREP(4,IH)-Priority type 4-flash	60-64	R
FREP(5,IH)-Priority type 5- presidential interrupt	65-69	R
FRER(IH)-Frequency of routine message arrival per hour	70-74	I
FREO(IH)-Frequency of arrival of other than routine messages per hour	75-79	I

The arrival time of the messages specified in IGR are determined stochastically. However, IGR is controlled by the variables FRER(IH) and FREO(IH). FRER is the frequency of arrival of routine messages per hour, while FREO is the frequency of arrival of other than routine messages (i. e., higher priority).

The columns of card type 7. 5 indicate the mean number of messages generated for each stimulus message in the Action Officer's inbox [RMPS(IT)]. A different generation rate may be indicated for each message type. The number of messages generated by IGP and IGR will be compounded by RMPS so that the number of messages available for processing each hour will be a variable with a lower limit of IGP + IGR.

Card Types 9 and 10

Card type 9 allows the option for skipping the error data of card type 10. Table 2-5 shows the input form for the error data, as indicated by card type 10. The errors produced in the processing of a message are stochastically determined using the input error rates specified for each type of error (IE). Four types of errors are considered: (1) commission--too much information has been supplied, (2) abbreviation, typographic, or spacing, (3) omission--the lack of information where information or an entry should have been made, and (4) other. The type 10 error data card also contains the error rate [ER(IE, IT)] for each type of message (IT). Capacity exists for eight message types, but only seven types are used at present. The error rates indicate the average number of errors per 100 characters printed or typed. Of the errors produced, some will be detected and corrected immediately; some will perturb the simulated computer resulting in an error return, and others will pass through and enter the computer data bank. The Action Officer's errors, which produce computer error returns, are indicated by the variable ERPG, while the percentage of the UIOD's errors which produce error returns is indicated by ERPI. These two variables (ERPG and ERPI) are indicated in the last two columns of the error data card.

Card Types 11, 12, and 13

Table 2-6 shows the input formats for the message length data. Card type 11 is the bypass option card. Card type 12 contains the mean number of characters [INC(IT)] read in for each message type, and card type 13 contains the standard deviation [INS(IT)] of this mean. Random numbers from a normal distribution are used in conjunction with the mean and standard deviation to determine the exact length of each message of the given type as it is created and added to the message flow.

Table 2-5

Input--Error Data

		Card Columns	Format
Read or skip error data (card type 9)			
ISKIP-	If equal to 1 skip to card type 11, if not equal to 1, read card type 10.....	1	I
Error data (card type 10)			
IE-	Type of error, 1= commission, 2= abbreviation, typographical or spacing, 3= omission, 4= other.....	1	I
ER(IE,1)-	Error rate per 100 characters of message type 1.....	2-9	R
ER(IE,2)-	Message type 2.....	10-17	R
ER(IE,3)-	Message type 3.....	18-25	R
ER(IE,4)-	Message type 4.....	26-33	R
ER(IE,5)-	Message type 5.....	34-41	R
ER(IE,6)-	Message type 6.....	42-49	R
ER(IE,7)-	Message type 7.....	50-57	R
ER(IE,8)-	Non functional.....	58-65	R
ERPG-	Percentage of G3/AO errors which produce error returns..	66-72	R
ERPI-	Percentage of UIOD errors which produce error returns...	73-79	R

Table 2-6

Input--Message Length Data

		Card Columns	Format
Read or skip message length data (card type 11)			
ISKIP-	If equal to 1, skip to card type 14 If not equal to 1, read card types 12 and 13.....	1	I
Read message length means (card type 12). Note: The variable INC is explicitly specified as REAL			
INC(1)-	Number of characters in transformed message type 1.....	1-9	R
INC(2)-	Message type 2.....	10-19	R
INC(3)-	Message type 3.....	20-29	R
INC(4)-	Message type 4.....	30-39	R
INC(5)-	Message type 5.....	40-49	R
INC(6)-	Message type 6.....	50-59	R
INC(7)-	Message type 7.....	60-69	R
INC(8)-	Non functional.....	70-79	R
Read message length standard deviations (card type 13). Note: The variable INS is explicitly specified as REAL.			
INS(1)-	Standard deviation of characters in transformed message type 1.....	1-9	R
INS(2)-	Message type 2.....	10-19	R
INS(3)-	Message type 3.....	20-29	R
INS(4)-	Message type 4.....	30-39	R
INS(5)-	Message type 5.....	40-49	R
INS(6)-	Message type 6.....	50-59	R
INS(7)-	Message type 7.....	60-69	R
INS(8)-	Non functional.....	70-79	R

Card Types 14 and 15

Card type 14 allows a task analysis bypass. The input form for the card type 15 task analytic procedure is shown in Table 2-7. The number of cards expected has been previously indicated by NTE on the type 1 card. Each task analysis card identifies the task analysis number (K), as well as the task element number (I) being described. Five types of tasks [JTYPE(I, K)] may be used. Type 1 identifies a task which allows message rejection at a probability specified by AVPROB(I, K). A rejected message will be held unprocessed in the queue until the next hour, at which time it will be resubmitted for processing. A type 2 element is one whose time refers to a per character processing time. This per character time will be combined with the actual number of characters in a particular message to determine the total processing time. A type 3 element is a decision element. In a decision element, the operator speed factor, precision factor, and stress level do not affect the outcome. This type task is used when a situation independent branching function is incorporated in a task procedure. A similar feature is found in the type 4 element. Type 4 identifies an equipment task whose performance is independent of all operator characteristics. This task is used where the time control aspect of the task is determined by the equipment, e. g., warm up time, computer response time.

Task type 5 is not used at the present.

Task type 6 is a special type of branching task which will receive either an ERR (i. e., simulated error response, the simulated computer will not accept transmission, try again) or a CDR (correct reception). The number of error returns is a function of errors generated by both the Action Officer and the UIOD operator during the preparation and typing of the message. If an error message is received, then human decision time and information search time will be computed and added to the duration of this element. If no error message data were entered for a given simulation, then the element will simply cause the failure of task sequence route to be followed.

The criticality of the task [CRIT(I, K)] is indicated by the entry of a C in column 8 of card type 15. Task criticality is used in the computation of the overall effectiveness measure. Failure of a critical task is recorded and is considered to be detrimental to mission effectiveness.

Table 2-7

Input--Task Analytic Data

		Card Column	Format
Read or skip task analysis (card type 14)			
ISKIP-	If equal to 1, skip to card type 16..... If not equal to 1, read card type 15.	1	I
Task analysis (card type 15) One card for each task element specified by NTE in card type 2.			
K-	Task analysis number.....	1-2	I
I-	Task element number within this task analysis.....	3-5	I
JTYPE(I,K)-	Task element type where 1= a task element on which the message may be rejected with a probability specified by AVPROB(I,K), 2= a task element in which the number of characters for this message type will be multiplied times the stochastically determined mean time to produce the time required to transform the message, 3= a decision task element where operator factors such as speed [F(M)], precision [PREC(M)] and stress level [STR(M)] are not allowed to affect the duration or success probability of the task element, 4= an equipment task element where operator factors are considered and the task cannot be failed, 5= not used, 6= a special type of branch task element where either a "COR" or "ERR" response is expected.....	7	I
CRIT(I,K)-	Criticality of the task element. C= critical, not C is not critical.....	8	A
END(I,K)-	Message processing segment ended by this task element, if any.....	10	I
IJF(I,K)-	The number of the task element which will follow this one if this task element is a failure.....	12-14	I
IJS(I,K)-	The number of the task element which will follow this one if this task element is a success.....	15-17	I
AVGTM(I,K)-	Task element mean performance time.....	20-29	R
SIGMA(I,K)-	Standard deviation of AVGTM(I,K).....	30-39	R
AVPROB(I,K)-	Task element success probability, the probability that the following task will be IJS(I,K) and not IJF. Also the probability of message rejection when JTYPE(I,K)= 1.....	40-49	R
UETYPE(I,K)-	Undetected error type T= transform, not T= all others.....	50	A
UEP(I,K)	Undetected error probability.....	51-56	R
INTS-	Number of personal interruption types to be considered on this task element. This value determines the number of interruption data cards to be read in. (INTS $\leq$ 4 read 1 additional card; 5 $\leq$ INTS $\leq$ 9 read 2 cards).....	80	I
Interruption data (separate card(s) 4 interruptions/card)			
ITYP-	Type of interruption, up to four on a card.....	2,22,42,62	I
PROB(I,K,ITYP)-	Probability of this type of interruption.....	3-8,23-28,43-48,63-68	R
ITE(I,K,ITYP)-	Average duration of interrupt.....	9-14,29-34,49-54,69-74	R
ADI(I,K,ITYP)-	Standard deviation of interruption.....	15-20,35-40,55-60,75-80	R

Message processing time within the model is divided into message segments. These segments are based on Baker's (1970) categorization of message handling functions. These time segments are described in the section on model output. The entry in column 10 of each card type 15 indicates the time segment which ends for a given message when the simulation of the performance of the task element being considered by the type 15 card is completed.

The progression of an operator through a task analytic sequence need not be linear. The sequence to be followed may be in any order (with the exception that element 1 must be first) and is determined by whether the current task element is failed or performed successfully. If the current task is failed, the next task to be performed is indicated by IJF(I, K) and if the task is performed successfully, the next task to be performed is indicated by IJS(I, K). Frequently, the current task should be repeated, in case of a failure [IJF(I, K) = I]. Looping back to a previous task (loops should be written very carefully to avoid perpetual loops) or going on to a special task element (i. e., one not performed except in case of failure) are also acceptable alternatives. In the case of an element identified as type 6, the element cannot be failed in the normal sense and the failure sequence will be triggered by an error message logic which does not involve the random walk and the vocalic center group concepts described later.

The sequence number in IJS or IJF (as applicable) will determine the task element to be performed next. A blank or zero entry identifies the completion of the task. A task analysis may have any number of completion points.

The durations for task elements are taken from a normal distribution with an input mean of AVGTM(I, K) and a standard deviation of SIGMA(I, K). These times will be varied stochastically within the model and will tend to be increased by fatigue and decreased by stress. The values used for AVGTM may be obtained through expert judgment, actually timing operations in the field, or some standardized data bank of performance time. The probability that the task element will be performed successfully is indicated by AVPROB (I, K). The probability of failure on that task element is therefore 1 minus AVPROB. In the case of commonly performed elements, success rates in the range . 90 to . 98 are most frequently used.

Errors are assumed to be either detected or undetected. Detected errors are those which are indicated at some point by operators or by the computer. Undetected errors are those that remain undetected and enter the simulated computer's data bank. The only undetected error type simulated in the MANMOD is the transform type, i. e., where information is transformed from one form to an another by the operators. A transform element is indicated by a T in the UETYPE(I, K) column of card type 15.

When a transform element is indicated, the probability that an undetected error will enter the data base [UEP(I, K)] must also be indicated. Unless a type T is indicated in UETYPE, it does not matter what is in UEP (I, K). Undetected errors in the computer data base lower the results of the computations of system effectiveness.

Card Types 16 and 17

Table 2-8 shows the input format of the effectiveness correlations and weights. The components of these effectiveness measures are described in Siegel, Wolf, and Leahy (1973a).

The final entry on card type 15, INTS, controls the input of personal interruption data. These interruptions include such considerations as personal comfort and interruptions from phone calls. Up to 9 types of interruptions may be considered for any task element. A separate card (cards) is (are) employed to describe this interruption.

Table 2-8

Input--Effectiveness Component Data

		Card Columns	Format
Read or skip effectiveness components (card type 16)			
ISKIP-	If equal to 1 skip to read card type 18. If not equal to 1 read card type 17.....	1	I
Effectiveness components (card type 17)			
CC12-	Correlation between thoroughness and completeness.....	1-4	R
CC13-	Correlation between thoroughness and responsiveness.....	5-9	R
CC14-	Correlation between thoroughness and accuracy.....	10-14	R
CC23-	Correlation between completeness and responsiveness.....	15-19	R
CC24-	Correlation between completeness and accuracy.....	20-24	R
CC34-	Correlation between responsiveness and accuracy.....	25-29	R
W(1)-	Relative weight of thoroughness in computing overall effectiveness.....	30-34	R
W(2)-	Weight of completeness.....	35-39	R
W(3)-	Weight of responsiveness.....	40-44	R
W(4)-	Weight of accuracy.....	45-49	R

The weights must sum to 1.0.

Card type 16 is the bypass option and card type 17 contains the effectiveness correlations and weights. These are needed to compute system effectiveness and have been left as a variable because it is believed that these values may change over time. Values currently suggested for entry are:

Effectiveness Component	Suggested Entry
CC12	.50
CC13	.50
CC14	.50
CC23	.50
CC24	.50
CC34	.50
W(1)	.25
W(2)	.25
W(3)	.25
W(4)	.25

Card Types 18 through 27

The entry of error message data is an option which must be specified on the parameter card. Having specified the option, a full set of error message data must be entered. Table 2-9 lists the error message and associated random walk data. The first card (card 18) specifies the number of error messages to be read. This number of error messages must be described in terms of number of vocalic center groups (NVGM) on the following card or cards. The vocalic center group concept is described in the body of the report of which this user's manual forms an appendix. Up to 40 messages may be described on a single computer card. If 41 messages are specified, a second card will be read, but only the first value on that card will be entered.

The number of information search options available to the operator is read in next (card type 19). An information search option is any procedure that a simulated operator might follow in order to determine the error in his message which has produced computer generated error return. It includes such possibilities as consulting reference materials and asking other operators for information. The number of options specified determines the number of option data cards used. The first option datum read in is the option number. Following the option number, the probability that this option would be selected (PROBOP) is entered. This probability must be specified as a cumulative proportion. That is, if options 1, 2, and 3 possess respectively real probabilities of .20, .50, and .30, the entry data would be expressed as .20, .70, and 1.0. The highest option number available must

Table 2-9

Input of Error Message and Random Walk Data

Card Type	Variable	Description	Format	Card Columns
18	NE	Temporary indexer for number of error messages (NERMSG). If equal to zero no type 19 cards will be read in.	I3	1
19	NVGM(NE)	The number of Vocalic Center Groups for each error message will be read in. Up to 99 VCG's may be specified for each. Up to 40 entries are inputted on each card up to a maximum of 100 error message descriptors.	40I2	1-2, 3-4,etc.
20	NOP	Temporary indexer for the number of information search options (NOPTIO) for tracing down responses to error messages. If NOP is equal to zero no type 21 cards will be read in. NOP determines the number of type 21 cards read in. (Maximum of 9).	I2	1-2
21	I	The information search option on this card.	I2	1-2
	PROBOP(I)	The probability (cumulative as I goes from 1 to NOP) that option I will be selected for performance.	F10.3	3-12
	TIMCOR(I)	The mean time to perform information search option I.	F10.3	13-22
	SDCOR(I)	The standard deviation of TIMCOR(I).	F10.3	23-32
	REDAM(I)	The ambiguity reduction factor produced by this option.	F10.3	33-42
	DESCOP(I,3)	A prose description of the option.	3A6	43-60
22	I	Indicator for whether correction submission data is to be read in. If equals 1, no type 23 cards will be read in.	I1	1
23	PROBCR	The probability that a change in response to an error message will be correct.	F10.3	1-10
	AVCOR	The mean time required to input and send a change.	F10.3	11-20
	SDACR	The standard deviation of AVCOR.	F10.3	21-30
24	I	Option for reading in random walk data (1= yes). If not equal 1, then card type 25 is not expected.	I1	1
25	TSTEP	The time required to take each step in the random walk, whether left or right or circular.	F10.3	1-10
	PRBRT	The probability of moving right, or toward solution 1 within the one dimensional random walk.	F10.3	11-20
	PRBWR	The probability of moving left, or toward solution 2 within the random walk.	F10.3	21-30
26	I	Option for reading in cut off points for levels of ambiguity with regard to the number of Vocalic Center Groups. If equal to 1, no card type 27 will be expected.	I1	1
27	LEV(IL)	The cut off points for level of ambiguity where levels 1 and 5 are absorbing states and constitute zero and complete ambiguity respectively.	5I5	1-5, 6-10,etc.

have an expressed probability of 1.0. All probabilities higher than 1.0 are treated as if they were 1.0.

The time required to perform each option is stochastically computed from a normal distribution with a mean of TIMCOR and a standard deviation of SDCOR. It is assumed that each information search option has some value in helping the operator determine the solution to the problem posed by the error message. This value is termed the ambiguity reduction factor (REDAM). Ambiguity reduction is expressed as a proportion where a value of 1.0 describes an information source which always provides a solution, i.e., removes all ambiguity. A value of .50 would indicate a source which, on the average, reduces the ambiguity by one-half.

The final information search descriptor is completely optional. A prose description of the search option up to 18 characters in length may be included. This prose description will be displayed to the terminal when experimental control of parameters is desired and will be printed out with the other task information when the detail message processing option is called.

The next category of information to be entered is the correction submission data (card type 22). First, an indicator of whether such data should be read in is required. A 1 in the first column will cause the computer program to bypass the inputting of correction submission data. By bypassing, we mean here (as elsewhere) that the section in the program which reads in such data and stores it in the appropriate place is skipped. The cards themselves are not skipped.

Correction submission data are used when the operator has found a solution to the error message and proceeds to modify the original message. The probability that the solution will correct the message to the satisfaction of the computer is stored in PROBCR. The time to perform such a modification is taken from a normal distribution of mean AVCOR and a standard deviation of SDACR (card type 23).

The simulation of the decision making is performed through the use of a random walk model. The random walk simulation will result in either finding a solution to the problem posed by the error message or will result in a decision of no immediate solution and information search will commence. The input data required are the time required to take each step within the random walk (TSTEP) and the probabilities of moving to a solution (PRBRT) or toward no solution (PRBWR). These are entered on card type 25. These probabilities need not sum to 1.0. The difference between their sum and 1.0 is taken to be the standstill probability, i.e., the probability of moving neither towards or away from a solution. Here, time is spent in the decision making process, but no movement is achieved toward a solution.

The starting point within the random walk has an effect on whether or not and how quickly a solution is reached. There are five possible starting points--locations 1, 2, 3, 4, and 5. Location 1 represents reaching a solution, while location 5 represents deciding that no solution is immediately apparent. The option to read in new cutoff points is triggered by a blank card type 26, while a card type 26 with a 1 in column 1 will bypass this option. The cutoff points (LEV) are in order from 1 to 5 (card type 27), and indicate the highest number of vocalic center groups which an error message may have and still be considered in that category. The smallest number is indicated by the highest number plus 1 of the previous category. For example, if 0, 5, 10, 20, 100 were entered for cutoff points, then no message could have zero vocalic center groups. Therefore, none could start in category 1. A message with six vocalic center groups would be in category 3 since it has more than 5 but less than 10 VCG's. The cutoff points for VCG's should be determined from a study of the distribution of the frequency of occurrence in the error messages under consideration. In the case of an unavailability of such data, the data shown in Table 2-10 may be used. The Table 2-10 data were obtained from an analysis of the vocalic center groups in all current TOS error messages.

Table 2-10

Categorization of Vocalic Center Groups (VCG's) in Current TOS Error Messages

Category	Number of VCG's
1	≤ 4
2	> 4 ≤ 7
3	> 7 ≤ 10
4	> 10 ≤ 14
5	> 14

Card Types 28 and 29

In some versions of the TOS, only one tie line is available from the computer. This tie line is used alternately by the CRT terminal and the printer. An incoming message of higher priority than the current message of the UIOD is assumed to have precedence and to cause an interruption and delay in the processing of the current message. (Note: This data is optional and controlled by the value of INTOP on the #2 card.) These incoming messages are generated stochastically with a near frequency of FRHR(IH) per hour (card type 28). Also entered are the mean and standard deviations of the interruption, DURIN(IH) and SDIN(IH).

The computer may be accepting input from a number of terminals at the same time. Transmission delay will result, and this effect is activated by entering the mean and standard deviation of the delays per hour, DEL(IH) and DELSD(IH)., as shown in Table 2-11.

Table 2-11

Input of Incoming Message Interruptions and Transmission Delay Data

Card	Variable	Description	Card Columns	Format
28	IH	Hour number (one for each hour)	I5	1-5
	FRHR(IH)	Frequency of incoming messages of priority greater than 1 for hour IH	F5.0	6-10
	DURIN(IH)	Mean duration of incoming messages in hour	F10.2	11-20
	SDIN(IH)	Standard deviation of DURIN(IH)	F10.2	21-30
	DEL(IH)	Mean duration of transmission to computer time	F10.2	31-40
	DELSD(IH)	Standard deviation of DEL(IH)	F10.2	41-50
29	IREP	Indicator to read in more normal input data from card file (1= Yes).	I1	1

Card type 29 controls the option to read in part or all of a new simulation scenario. If a 1 is entered, the program will start again and read in a new card type 1.

Output

The results of the simulation are displayed as printout. The results calculations and the output formats are described in Chapter III of this report. Provision is also made for input display. The various input displays are presented in Figures 2-1 through 2-4. Figure 2-1 generally contains information relative to the scenario simulated including items such as manning factors and message input. Figure 2-2 presents task analytic information input and the input correlations between the components of the effectiveness components and the weights of each component. Figure 2-3 shows the various input records relative to the error message, information search, and random walk input. Figure 2-4 presents simular information relative to interruptions and transmission delays.

TEST CASE WITH ERROR DATA INCLUDED

NO. OF SHIFT ITERATIONS	2	NO. OF SIMULATED DAY	11
NO. OF HOURS PER SHIFT	1	INITIAL BACKLOG '63	5
NO. OF ACTION OFFICIERS	2	RANDOM NUMBER	.01111111
ERROR MESSAGES	1		
NO. OF IOD OPERATORS	1		

PROBABILITY OF UNDETECTED ERROR IN CCC		SYSTEM RESPONSE TIME TO INQUIRY	
LOW IMPORTANCE	.000	MEAN	.000
SIGNIFICANT	.000	SD	.000

OPERATOR PARAMETERS

MAN	SPEED	PRECISION	STRESS THRESHOLD	ASPIRATION
OPER 1	1.00	1.00	10.00	.900
OPER 2	1.00	1.00	10.00	.900
OPER 3	1.00	1.00	10.00	.900

MESSAGES PER STIMULUS BY TYPE

1	2	3	4	5	6	7
.00	.00	.00	.00	.00	.00	.00

HOUR PARAMETERS

	CUMULATIVE MESSAGE FREQUENCY BY TYPE								CUM. MSG FREQ. BY PRIORITY					-------INPUT MESSAGES FROM OUTSIDE		
HOUR	1	2	3	4	5	6	7	8	1	2	3	4	5	DELIVERIES PER HOUR ROUTINE	NOT-ROUTINE	NUMBER OF M LAST 1/4 HR
1	1.00	.00	.00	.00	.00	.00	.00		1.00	.00	.00	.00	.00	.0	.0	1

ERROR FREQUENCY

	MESSAGE TYPE							ERROR RETURNS	
TYPE	1	2	3	4	5	6	7	8	63	IOD
1	.08	.00	.00	.00	.00	.00	.00		.744	.000
2	.02	.00	.00	.00	.00	.00	.00		.744	.000
3	.15	.00	.00	.00	.00	.00	.00		.744	.000
4	.05	.00	.00	.00	.00	.00	.00		.744	.000

NO. OF CHARACTERS	MESSAGE TYPE							
	1	2	3	4	5	6	7	8
IN COMPUTER (M)	65.00	.00	.00	.00	.00	.00	.00	
IN COMPUTER (SD)	26.00	.00	.00	.00	.00	.00	.00	

Figure 2-1. Printout record of input data.

TASK ANALYTIC DATA

TASK	ELEMENT	TYPE	CRITICAL	SEGMENT	NEXT-FAIL	NEXT-SUCC	MEAN-TIME	SIGMA	PROBABILITY	UNDETECTED-ERROR TYPE	UNDETECTED-ERROR PROB
1											
	1	0	C	3	1	2	15.00	4.00	.990		.00
	INTERUPTION TYPE 1 PROBABILITY= 1.000 MEAN DURATION= 10.0 SD= 1.5										
	2	0		0	2	3	12.00	2.50	.900		.00
	3	0		0	3	4	12.00	2.50	.900		.00
	INTERUPTION TYPE 1 PROBABILITY= .400 MEAN DURATION= 7.4 SD= .7										
	INTERUPTION TYPE 2 PROBABILITY= .700 MEAN DURATION= 30.0 SD= 3.5										
	4	2	C	0	5	5	3.09	.50	1.000	T	.00
	5	0	C	0	6	6	10.00	2.00	.660		.00
	6	0		0	5	7	15.00	2.70	.800		.00
	7	0	C	4	7	0	5.00	1.50	1.000		.00
2											
	1	0		5	1	2	7.00	1.50	.990		.00
	2	0	C	6	2	3	5.00	1.00	.960		.00
	3	6		0	4	4	.30	.02	1.000		.00
	4	2	C	0	5	5	2.37	.47	1.000		.00
	5	0		0	5	6	12.00	3.00	.700		.00
	6	0	C	7	6	0	4.20	1.20	1.000		.00

TASK ANALYSIS ALLOCATION

	MESSAGE TYPE							
OPERATOR	1	2	3	4	5	6	7	8
1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2

EFFECTIVENESS COMPONENTS

CORRELATIONS BETWEEN COMPONENTS

CC12= .500
CC13= .500
CC14= .500
CC23= .500
CC24= .500
CC34= .500

WEIGHTS OF EACH COMPONENT

W(1)= .250
W(2)= .250
W(3)= .250
W(4)= .250

Figure 2-2. Task analysis related and effectiveness components input record.

ERROR MESSAGE DATA

ERROR MESSAGE NO	VOCALIC CENTRAL GROUPS
1	3
2	7
3	9
4	12
5	84

INFORMATION SEARCH DATA

OPTION	PROBABILITY	MEAN	SD	AMBIGUITY REDUCTION	DESCRIPTION
1	.300	20.0	2.0	.10	AO
2	.700	40.0	4.0	.20	GLOSSARY
3	1.000	60.0	6.0	.30	NEIGHBOR

CORRECTION SUBMISSION DATA

PROBABILITY THAT THE CHANGE ENTERED IS CORRECT	.700
MEAN TIME TO ENTER CHANGE	25.00
STANDARD DEVIATION	2.50

RANDOM WALK DATA

TIME REQUIRED PER STEP	4.500
PROBABILITY OF MOVING RIGHT	.600
PROBABILITY OF MOVING LEFT	.300

LEVELS OF AMBIGUITY

LEVEL	VCGS
1	1
2	5
3	10
4	50
5	0

Figure 2-3. Error message and related input record.

INTERRUPTION AND TRANSMISSION DELAY DATA

HOUR	------INTERUPTIONS------ FREQUENCY	DURATION	SD	TRANSMISSION MEAN	SD
1	15.0	17.5	3.2	5.10	1.70

Figure 2-4. Interruption and transmission delay input record.

CHAPTER III

OPERATIONS AND OUTPUT

In order to call up the full integrated model, some type of terminal is required. The displays and procedures detailed in this section are most appropriate for implementation on the ADS 660 terminal. However, almost any other terminal possessing the appropriate transmission rate may be used.

To implement the integrated model, the first step is to call up the computer and wait until the connect signal (usually a light appears). Next, a computer interface port must be specified such as: #ARI04. A run card must appear next: @RUN run name, charge no, project id, 10, 100. The run name is completely arbitrary and is used only for run identification. The programmer's last name or initials are commonly used. A valid charge number is essential. A project identification of MANMOD is recommended, although not absolutely necessary.

The project identification is followed by an estimated computer running time in minutes (a value preceded by the letter S may be used to specify seconds) and then by the maximum number of pages of computer printout. In order to execute the program, only the statement @ADD TRY· MANMOD is required. Following this instruction, the computer will respond with a series of READY's which refer to the various files being assigned. After all files are ready, the program starts. First, the normal input is read, and then the statement.

APPLIED PSYCHOLOGICAL SERVICES PRESENTS appears on the screen. This statement is followed by basic instructions for use.

After the message is complete, depressing the new line button (if the conversational mode is being used) or the XMIT button if the message mode is used will permit the computer to go on to the next display.

In the next display, the operator is asked to select a data category for change. If no category is selected, normal simulation will commence. If one of the data categories (from 1 to 22) is selected, then the next message will provide an opportunity to change any of the data forms. If the number 99 is selected, an index to the available data categories is presented. If any other number is chosen, the program commits a normal termination. This is the preferred and optimal way to end the program. Other methods may provide problems for data recovery from the normal output file.

Revised CASE Employment

When data change option 22 is selected, data may be read in from the revised CASE program. The data to be read in consists of the total duration (cumulative) and frequency of interruption at each of the nodes (i. e., intersection or choice points) preselected in the revised CASE model. Of these nodes, only a few are of interest for the MANMOD and these must be identified. After the appropriate nodes (the correct nodes for the test case are 16, 38, and 50) are indicated, the program computes means, and these are displayed on the terminal where changes can be made if the data are unacceptable. These changes are optional and keyed to the hour number. If no hour number is indicated, no change will be made.

In order to execute the revised CASE from the terminal, the instruction

@ADD TRY·RCASE

must be used before the MANMOD implementation described above. When all program files are ready, the CRT will display information concerning the revised CASE model and ask for the project number, title, and the date. After this information is sent, the program will automatically write the interactive information to the correct file. After the CASE program has ended, the MANMOD program should be called to integrate the data.

At the conclusion of the MANMOD simulation, a brief summary display appears. This summary may be followed, at user option, by detailed displays. To accomplish this, the hour number of interest is entered. Entry of a zero hour number returns the program to normal operation and the program may be terminated.

After the program has been terminated, the billing file should be closed by the instruction @FIN. If the port is to be closed (i. e., no other users at current time), then the instruction @@TERM should be entered. The "connect" light should go out at this time and the phone should be hung up.

Detailed Output

In order to have the detailed simulation results printed, instructions may be entered via CRT or batch terminals.

In the case of the CRT, the following instructions are required:

```
@ RUN...      (if no run is active)
@ ASG,LP      T
@ BRKPT       PRINT$/T
@ DATA, L     PRTFIL
@ END
@ BRKPT       PRINT$
@ FREE        T
@ SYM         T, ARI318
@ FIN
```

The designation ARI318 identifies the remote batch terminal at the Army Research Institute for the Behavioral and Social Sciences.

In order to receive the print from cards directly, the following cards must be punched and submitted:

```
@ RUN...
@ ASG, A      MANMOD*PRTFIL
@ DATA, L     MANMOD*PRTFIL
@ END
@ EOF
```

In the case that a printer is not immediately available, printouts may be directed to the Edgewood Arsenal for mailing to the user. The required instructions in this case are:

```
@ RUN...
@ SUSPEND
@ DATA, L     MANMOD*PRTFIL
@ END
@ RESUME, P
@ FIN
```

The P option following the instruction RESUME will cause an immediate printout (when a printer is available) at the U1108 facility at the Edgewood Arsenal.

Output Format

The MANMOD provides a variety of output options. The sections which follow describe this output in detail.

Detailed Message Output

A detailed summary can be produced for each simulated message involved in a simulation run. Figure 3-1 shows a sample of this printout and presents the detailed processing data for simulated message number 1, relative to the work of simulated operator number 3. In the Figure 3-1 sample, an ADD type message was processed which was in the first position ("order") in the IOD queue. There was no stress, fatigue, or aspiration influence (1.00 is the steady state or no influence level). Note that aspiration as used here does not refer to the level of aspiration but to the effect of aspiration level on current performance.

A CUM. IDLE of 344.68 means that this crewman has spent this amount of time (in seconds) waiting for a message in this hour. When operator 3 received the message, MESSAGE ARRIVAL 344.7, he began to work on it immediately (MESSAGE START 344.7).

Completion of the first task analytic element took him 7.31 seconds to perform, augmented cumulative elapsed time to 351.99, and the performance was successful (S). The first task element was not a special kind of task or a critical task, and ended time segment 5 (this segment identifies the end of time to select a message from queue). There are sufficient errors already in the current message to produce 5 error returns and no interruptions occurred during this task.

The data starting with TRANSMISSION DELAY refer to task element 3 which is a type 6 task. Type 6 identifies a transmission to the computer. It took 5.3 seconds to transmit the message (due to time sharing delays on the line). An error message level 4 was returned which had an ambiguity level (i.e., number of vocalic central groups) of 12. In the random walk simulation of information processing, only one step was taken which required 4.5 seconds. Absorption was reached at the no solution exit. Since no immediate solution was apparent to the operator, he selected information search option 3, which consists of asking his neighbor (i.e., fellow IOD operator). This took 64.8 seconds and reduced his ambiguity level to 1. He then produced, considered, evaluated (random walk), and reached a solution which took 24 seconds to enter into the computer. The solution was incorrect. Due to the nature of this particular task analytic input, the operator went on to the next task. More often, the task analysis would

```
          TEST CASE WITH ERROR DATA INCLUDED

          MESSAGE NUMBER      1          MAN            OPER 3          DAY          11
          MESSAGE TYPE        ADD        STRESS FACTOR    1.00          HOUR          1
          MESSAGE ORDER       1          FATIGUE          1.00          ITERATION     1
                                         ASPIRATION       1.00
                                         CUM. IDLE      344.68

          MESSAGE ARRIVAL     344.7
          MESSAGE START       344.7


          ELEMENT   EXECUTION CUMULATIVE OUTCOME   TYPE OF  CRITIC  SEGMENT   ERROR      ERROR
           NO.        TIME      TIME     (SER)    ELEMENT  -ALITY  ENDED     TYPE     RETURNS  INTRP

             1         7.31     351.99     S         0               5                    5   .00     0
             2         4.66     356.65     S         0        C      6                    5   .00     0
    TRANSMISSION DELAY=     5.2657
    ERROR MSG =  4  AMBIGUITY LEVEL =  12
      MSG EVAL RQD   1 STEPS,   4.5 SEC., CONCLUSION =  2 (2 = NO SOLUTION REACHED)
      INFO SEARCH OPTION =  3 (  NEIGHBOR          ), TIME=  64.8 SEC., NEW AMBIGUITY =  1
      MSG EVAL RQD   1 STEPS,   4.5 SEC., CONCLUSION =  1 (2 = NO SOLUTION REACHED)
    TRANSMISSION DELAY FOR CORRECTED MESSAGES =    4.13407
      TIME TO ENTER CORRECTION =  24.0 SEC., OUTCOME=  2 (1= CORRECT SOLUTION)
             3         5.58     459.75     S         6               0                    4   .00     0
             4       120.38     588.13     S         2        C      0                    4   .00     0
             5        11.24     599.37     S         0               0                    4   .00     0
             6         3.45     602.82     S         0        C      7                    4   .00     0

          MESSAGE   1
           COMPLETED BY OPER 3
           TRANSFORM ERRORS
            COMMISSION              0
            ABREV/TYPO/SPAC         0
            OMISSION                0
           OTHER ERRORS             0
                                   ----
           TOT. UNDET.  ERRORS      0

           NO. ERROR RETURNS        5
           INFORMATION LOSS         0

             MESSAGE NO.     1
    SEGMENT  1         2         3         4         5         6         7

             .0        .0       26.7      344.7     352.0     356.7     602.8
```

Figure 3-1. Sample detailed message processing output.

indicate that the operator should repeat task element 3 until the task is completed successfully. The lower portion of the printout indicates that message 1 was completed by operator 3 with no transform errors but with a total of 5 error returns. The message segment end points were 0, . 0, 26. 7, 349. 7, 352. 0, 356. 7, and 602. 8.

Hourly Summary

Figure 3-2 presents a sample of the hourly summary which can be produced for each simulated hour. In the Figure 3-2 sample, man 1 completed six messages; no messages were rejected or interrupted; the man worked 1658. 1 seconds out of the hour and he waited for new messages to come in for 1941. 9 seconds. No stress occurred during the hour, and the level of aspiration was . 90. This value is in perfect accordance with the level of performance.

Man number 3 completed five msssages, and one of these was interrupted. In this case, the interruption caused the processing of the interrupted message to run over the hour summary point. The message will be considered in the next hour summary, although man 3's work time in this hour is considered in the present hourly summary.

The average time to process a message was 1772. 7 seconds, and the overall effectiveness in the hour was . 58. This overall effectiveness was negatively affected by a very low responsiveness component (. 10). Responsiveness is low in this hour because all messages arrived at the beginning of the hour and, accordingly, some were necessarily delayed in a queue before they were processed. The other components of the effectiveness calculation were high. This indicated that once started, the messages were processed quickly with few errors.

All messages in this particular hour were of type 1. The summary in the lower portion of Figure 3-2 shows the average of time spent in each time segment by message type.

Iteration Summary

A brief summary is printed after every iteration. This summary presents the effectiveness components and overall effectiveness for every hour during the iteration. A sample of the output is shown in Figure 3-3.

END OF HOUR RESULTS HOUR 1
DAY 11
ITERATION 2

OPERATOR PERFORMANCE DATA

MAN	--MESSAGES-- COMPLETED	REJECTED	INTERRUPTED	--TIME-- WORKED	OTHER	------FINAL------ STRESS	ASPIRATION	PERFORM
1	6	0	0	1658.1	1941.9	.00	.90	.90
2	0	0	0	.0	3600.0	.00	.90	.90
3	5	0	1	2305.6	1294.4	.00	.90	.90

MESSAGE PERFORMANCE DATA
AVERAGE TIME PER MESSAGE 1772.7
MESSAGES IN A0-G3 QUEUE AT HOUR START 5
TOTAL INFORMATION LOSS 0
EFFECTIVENESS COMPONENTS
THOROUGHNESS .92
COMPLETENESS .90
RESPONSIVENESS .10
ACCURACY 1.00
EFFECTIVENESS= .58

DETAILED MESSAGE TIMING

CUMULATIVE MESSAGE NUMBER	TYPE	T1	T2	T3	T4	T5
1	1	.0	21.8	264.5	1116.8	3.3
2	1	286.3	26.8	283.0	952.0	7.1
3	1	596.2	24.2	241.2	903.2	5.3
4	1	861.6	31.1	211.7	879.6	6.2
5	1	1104.4	26.1	203.2	802.7	5.1

MESSAGE TYPE	NUMBER COMPLETED	T1	T2	T3	T4	T5
1	5	569.7	26.0	240.7	930.9	5.4
2	0	.0	.0	.0	.0	.0
3	0	.0	.0	.0	.0	.0
4	0	.0	.0	.0	.0	.0
5	0	.0	.0	.0	.0	.0
6	0	.0	.0	.0	.0	.0
7	0	.0	.0	.0	.0	.0

Figure 3-2. Sample hourly summary.

RESULTS OF SHIFT ITERATION 2

HOUR	THOROUGHNESS	COMPLETENESS	RESPONSIVENESS	ACCURACY	EFFECTIVENESS
1	.92	.90	.10	1.00	.58

Figure 3-3. Sample iteration summary.

Run Summary

Six different run summaries are provided. These are:

manpower utilization
time segment per message
effectiveness components
workload summary
error summary
error message processing

Figure 3-4 presents a sample manpower utilization summary. This simulation considered only one hour. Accordingly, the means across hours are the same as the hourly data.

In hour 1, man 1 worked 1831 seconds out of the hour or 51 per cent of the time (1831/3600 x 100). He processed six message units, where message units are the part of the message handling done by any one man. Man 1 used 305 seconds, on the average, to process these message units. He was never under stress and showed a slightly increased level of aspiration (. 901 versus . 900) over his original aspiration level. Total working times and means across all operators are also provided. All operators worked 43 per cent of the time on the average.

Message segment completion times are shown in Figure 3-5. These times represent:

T1 - Time spent waiting in Action Officer queue
T2 - Time to select a format and fill it out
T3 - Time spent waiting in UIOD queue
T4 - Time spent entering message
T5 - Time to send message

MANPOWER UTILIZATION

HOUR	MAN	TIME WORKED	PROP	TIME OTHER	MSG UNITS PROCESSED	MEAN TIME PER MESSAGE	FINAL STRESS	FINAL ASPIRATION
1								
	1	1831.	.51	1769.	6	305.	.000	.901
	2	0.	.00	3600.	0	0.	.000	.900
	3	1241.	.34	2359.	6	207.	.000	.924
MEANS FOR EACH MAN PER MESSAGE UNIT								
	1	1831.	.51	1769.	6	305.	.000	.901
	2	0.	.00	3600.	0	0.	.000	.900
	3	1241.	.34	2359.	6	207.	.000	.924
TOTALS		3072.		4128.	12	512.	.000	1.825
GRAND MEANS		1536.	.43	2064.	6	256.	.000	.913

Figure 3-4. Sample manpower utilization run summary.

TIME SEGMENTS

HOUR	T1 TIME	T1 PROP	T2 TIME	T2 PROP	T3 TIME	T3 PROP	T4 TIME	T4 PROP	T5 TIME	T5 PROP	TOTAL (SUM)	TOTAL MESSAGES
1	478.	.27	26.	.01	256.	.14	1025.	.57	5.	.00	1790.	8
MEAN	478.	.27	26.	.01	256.	.14	1025.	.57	5.	.00	1790.	8

TYPE MSG	T1 TIME	T1 PROP	T2 TIME	T2 PROP	T3 TIME	T3 PROP	T4 TIME	T4 PROP	T5 TIME	T5 PROP	TOTAL (SUM)	N CPL
1	478.	.27	26.	.01	256.	.14	1025.	.57	5.	.00	1790.	8

PRIOR MSG	T1 TIME	T1 PROP	T2 TIME	T2 PROP	T3 TIME	T3 PROP	T4 TIME	T4 PROP	T5 TIME	T5 PROP	TOTAL (SUM)	N CPL
1	478.	.27	26.	.01	256.	.14	1025.	.57	5.	.00	1790.	8

Figure 3-5. Sample time segments run summary.

The mean time across all time and messages to send a message in this run was 1790 seconds. (Note: the different summaries provided do not refer to the same run.) The time and the proportion of the total represented by this time are also shown in the time segment summary. These time segment data are averaged across hour, then averaged across message type (only one shown), and then averaged across message priority (only one shown).

Effectiveness Run Summary

The run summary also summarizes the effectiveness indices (Figure 3-6). These data represent means across iterations by hour and then means across hours for the overall measure.

Workload Summary

Figure 3-7 presents the workload summary format. The left side, backlog and messages delivered represent input values, while the right side shows actual processing rate averages.

Error Summary

Figure 3-8 presents a sample of the error summary. This output summarizes errors by hour and by error type. Also shown are the average number of error returns per message and the average information loss.

Error Message Summary

The error message summary is a new summary, not found in previous versions of the MANMOD. These data represent the mean time per hour per man spent in responding to and processing error messages. In the sample output shown in Figure 3-9, man 3 is the only IOD and hour 1 was the only hour simulated. During this simulation a mean time of 645.2 seconds was spent as a result of error messages.

HOUR	----COMPONENTS---- THOR	COMP	RESP	ACC	EFFECT-IVENESS
1	1.00	.95	.92	1.00	.97
MEAN	1.00	.95	.92	1.00	.97

Figure 3-6. Sample effectiveness run summary.

WORKLOAD SUMMARY

WORKLOAD	MESSAGES DELIVERED				-------MESSAGE UNITS-------- COMPLETED		REJECTED		INTERUPTED	
HOUR	AO/G3	IOD	LAST 1/4 HR	ANYTIME	AO/G3	IOD	AO/G3	IOD	AO/G3	IOD
1	5.0	.0	1	0	6.0	6.0	.0	.0	.0	.0

Fugure 3-7. Sample workload run summary.

ERROR SUMMARY - BY HOUR

HOUR	-------ERROR TYPE------ 1	2	3	4	ERROR RETURNS	INFORMATION LOSS	NUMBER OF MESSAGES UNITS
1	.1667	.0000	.0000	.0000	5.1667	.0000	12

ERROR SUMMARY - BY MESSAGE TYPE

MESSAGE TYPE	-------ERROR TYPE------ 1	2	3	4	ERROR RETURNS	INFORMATION LOSS	NUMBER OF MESSAGES UNITS
1	.1667	.0000	.0000	.0000	5.1667	.0000	12

Figure 3-8. Sample error run summary.

TIME SPENT IN RESPONSE TO ERROR MESSAGES

	HOUR											
MAN	1	2	3	4	5	6	7	8	9	10	11	12
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	645.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Figure 3-9. Sample error message run summary.

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APPENDIX A

Glossary

GLOSSARY

-A-

A--Temporary variable used when arithmetic calculations are made with an integer variable.

ACUMTC(IH,M)--Accumulated time spent on error message for run summary.

ADI(I,K,ITYP)--Standard deviation of AITE, the duration of task element interruptions.

AHT--Average handling time for a message. Measured from when a message is selected by an action officer to when the message is sent by the MJF.

AITE(I,K,ITYP)--Mean duration of task element.

AM--Mean number for poisson distribution.

AO--Action officer (not FORTRAN).

AQT--Average queue time for a message. Measured from when a message arrives in the action officer's inbox to when he selects it for processing.

ASP(M)--The aspiration level for each man. An aspiration of 1.0 represents striving for perfection. An aspiration level of .8 has been found appropriate in many situations.

ASS(M)--Mean final aspiration level.

ATPM--Average time per message processing.

AVAIL(M)--Availability indicator for each crewman, 1= availability.

AVCOR--The average time required to correct a message which produced an error message.

AVGTM(I,K)--Average task element performance time.

AVPROB(I,K)--Task element success probability. That is, the probability that the following task will be IJS and not IJF. Also the probability of a message rejection when JTYPE= 1.

-B-

B--Temporary variable used when calculations must be made using an integer variable.

BBIN--Number of messages in AO/G3's inbox of the beginning of the shift.

-C-

CC12--The average correlation between the effectiveness measures throroughness and completeness.

CC13--The average correlation between the effectiveness measures thoroughness and responsiveness.

CC14--The average correlation between the effectiveness measures thoroughness and accuracy.

CC23--The average correlation between the effectiveness measures completeness and responsiveness.

CC24--The average correlation between the effectiveness measures completeness and accuracy.

CC34--The average correlation between the effectiveness measures responsiveness and accuracy.

CEC(IH,IOP)--Accumulative effectiveness measures for run summary.

CFA(IH,M)--Cumulative final aspiration level for run summary.

CFS(IH,M)--Cumulative final stress level for run summary.

CH(IS)--Cumulative segment completion times.

CHAR(37)--The array in which characters are stored. In the order 1, 2,3,4,5,6,7,8,9, 0, blank, A, b,c,d,e,f,g,h,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z.

CIDH(IH,M)-- Cumulative time idle for run summary.

CMSG--Cumulative message number. A unique number (within iterations) assigned to each message when it is created. Explicity specified as REAL.

CMSGNO(MSG,J)--The cumulative message number of each message within the queues.

CMTG(IH,M)--Time spent on message processing per man per hour.

COMMNS(5)--Column means within chained runs.

CP(IP,IS)--Iteration mean performance time per priority per segment.

CRIT(I,K)--Criticality of the task element, C= critical.

CT(IT,IS)--Iteration total time per segment per message type.

CTSH(IH,IS)--Cumulative segment time by hour.

CTSP(IP,IS)--Cumulative time segments by message priority data for run summary.

CTST(IT,IS)--Cumulative time segments by message type data for run summary.

CTWH(IH,M)--Cumulative time worked for run summary.

-D-

D--Dummy indexer used for glossary reference to matrix.

DEL(IH)--Mean transmission to computer delay.

DELSD(IH)--Standard deviation of transmission to computer time.

DESCOP(NOP,3)--A prose description up to 18 characters in length for each information search option.

DURIN(IH)--Mean duration of interruption from incoming messages.

-E-

EC(IC)--The value of each effectiveness component.

EFF--Overall or composite effectiveness.

END(I,K)--Message processing segment, if any, ended by this task element.

ENDHR--End of the hour time.

ER(IE,IT)--Error rate per 100 characters for each type of error -IE- and each type of message, IT.

ERP(IE)--Percentage of errors which will cause computer error messages.

ERPG--Percentage of AO/G3 errors which will cause computer error messages.

ERPI--Percentage of UIOD errors which will cause computer error messages.

ERSUMT(IT,IOP)--Error sums within chained runs.

EXASP(M)--Aspiration level per man in run summary.

EXASPH(IH,M)--Aspiration level, run summary.

EXTPM(M)--Time per message, run summary.

EXTPMH(IH,M)--Time per message, run summary.

-F-

F(M)--The speed factor of each man. An average man would be 1.0. A fast man would be .8 and a slow man would be 1.2.

FREO(IH)--Frequency of arrival of other than routine messages per hour. Not the number of messages but the number of times during the hour at which messages might arrive.

FREP(IP,IH)--The cumulative proportional occurrence of message priority -IP- as IP goes from 1 to 5 during hour IH. The highest used priority within each hour must have a proportion of 1.0.

FRER(IH)--Frequencey of arrival of routine messages per hour. Not the number of messages but the number of times during the hour at which messages might arrive.

FRET(IT,IH)--The cumulative proportional occurence of message IT as IT goes from 1 to ITMAX during hour IH. For example FRET (1-7, 1) might be .1, .23, .25, .48, .73, .84, 1.00. Used in random calculation of actual message types in any given simulation hour.

FRHR(IH)--Frequency of interruptions from incoming messages per hour.

-G-

GMEANS--Grand means within chained runs.

GTSMNS--Grand total means within chained runs.

-H-

HROVER--Indicator for hour completion.

-I-

I--Task element number. Also temporary index.

IATA(J,IT)--Task analysis to be used for each operator type, J and for each message - IT.

IBLK1--Indicator within chained runs.

ICT--Temporary counter for number of messages.

ICHAIN--Shift number for this run if chaining option is being utilized. Should be set to zero if no chaining is desired.

IDAY--Day of mission simulation. Used in computation of datime.

IDENT(18)--A run description or header of 72 characters printed on the top of each page of printout.

IDL(IH,M)--The amount of idle time for each man in each hour.

IE--Error type, 1= commission, 2= typographic (includes abbreviation and spacing), 3= omission, 4= other.

IEND--Option to terminate program (when= 1).

IEK--Time segment indicator point.

IFTE(MSG,J)--Indicator for message interrupted by the end of the hour.

IFTET--Temporary storage for IFTE.

IGP(IH)--Number of messages arriving AO/G3's inbox in the last 15 minutes of hour IH.

IGR(IH)--Number of messages arriving in AO/G3's inbox randomly throughout this hour.

IH--Hour number.

IHH--Index for hour.

IHMAX--Number of hours simulated per iteration.

II--Temporary indexer.

IJF(I,K)--The number of the task element to be performed next if the current task element is failed.

IJS(I,K)--The number of the task element to be performed next if the current task element is performed successfully.

INC(IT)--[REAL] Mean number of characters in the final form of each message type, IT.

INFHR(IH)--Information lost per hour.

INFOLS(CMSG)--Information loss in current message.

INS(IT)--[REAL] Standard deviation of number of characters per message type, INC(IT).

INT(M)--Number of error returns remaining in hour interrupted message data.

INTOP--Option for card input of interruption and transmission delay.

INTS--Total number of interruptions to be run in a task element.

INTRPT(M)--Interruption indicator, 1= an incomplete message from previous hour must be completed before either messages are selected.

IOP--Option code.

IP--Message priority number where, 1= routine, 2= priority, 3= operational immediate, 4= flash, 5= presidential interrupt.

IPAGE--Page number of printout.

IPD--Random number from a poisson distribution.

IPRI(CMSG)--Message priority.

IPT1--Pointer for random access file 1.

IPT2--Pointer for random access file 2.

IPT3--Pointer for random access file 3.

IPT4--Pointer for random access file 4.

IPT5--Pointer for random access file 5.

IPT6--Pointer for random access file 6.

IREP--Indicator for sequential runs, 1= real data for new run, blank= terminate program.

IRESH(IOP,IH)--Information lost (IOP= 6) number of error returns (IOP= 5) tasks performed per hour (IOP= 7), IOP 1 to 4 accumulate errors per error type.

IREST(IOP,IT)--Information lost (IOP= 6), number or error return (IOP= 5), tasks performed (IOP= 7) per message type. IOP 1-4 accumulate number of errors per error type.

IS--Time segment for message processing.

ISAM--Output file for SAMTOS data.

ISEG--Time segment, 1= time of arrival in AO/G3's queue [TARIV(MSG,1)], 2= time AO/G3 begins message processing, 3= time AO/G3 selects format, 4= time message arrives in UIOD's queue, 5= time UIOD requests format, 6= time UIOD sends message successfully, 7= time UIOD finishes processing message.

ISKIP--Used in data input to skip reading various types of data. Used when making multiple batch runs where only a few variables are changed. The data inputted in previous runs will be used unless new data is read in.

ISTKNT(IP)--The weights per message priority used in computing operator stress.

IT--Message type, 1= add data, 2= change data, 3= delete data, 4= query, 5= relay, 6= special process request, 7= standing request for information.

ITEM--Temporary storage for (MSGNO(I,J).

ITYMAX--Maximum number of interruption types per task element.

ITYP--Interruption type.

IUR(IH)--Not used.

-J-

J--Operator type, 1= action officer, 2= UIOD.

JE--Index for type of message and other purposes.

JJ--Temporary index for operator type.

JTYPE(I,K)--Task element type for element I of task analysis K. Allowable types are, 1= a task element allows the message to be rejected with a probability of AVPROB(I,K), 2= task element in which the number of characters for this message type will be multiplied times the stochastically determined mean time to produce the time required to transform the messages, 3= a decision task element where operator factors such as speed - F(M), precision-PREC(M), and stress level - STR(M) are not allowed to affect the duration or success probability of the task element, 4= an equipment task element where operator factors are not considered and the task can not be failed, 5= not used, 6= a branch task in which a computer error message causes a branch back to the message correction input task element.

-K-

K--Task analysis number.

KINKS--Number of messages interrupted for hourly processing.

KK--Temporary index for message queue and others.

-L-

LDONE--Counter for crew who have completed the working hour.

LENTH(MSG,J)--Number of characters in message.

LENTHT--Temporary storage for LENTH.

LEV(IL)--Cut off points for levels of ambiguity. Expressing maximum number of vocalic central groups and used for determining starting point within the random walk decision making model.

LINE--Counter for line of print written for chained runs.

LOGBAC(IH,J)--Number of messages carried over from previous hour.

-M-

M--Man number. Each man involved in a simulation is assigned a unique number.

MAN(MSG,J)--Man who is processing message.

MANT--Temporary storage for MAN.

MCL(M)--Messages completed per man for run summary.

MCUM--Cumulative message number of current message.

MEN(D)--Number of men, D= 1 for action officers (including G3), D= 2 for UIOD's, D= 3 for total men in system.

MENS--Total number of men in system.

MESS(LA,J)--Messages for performance this hour, LA= 1 total for hour; LA= 2 messages remaining for hour. This category is decreased as messages are performed.

MGCP(IH,M)--Cumulative messages completed.

MINT--Man interrupted by hour statistics.

MQCPL(IH,M)--Messages completed per hour per man.

MQINT(IH,J)--Number of messages in the queue interrupted each hour.

MQREJ(IH,M)--Messages rejected per hour per man.

MSCPL(M)--Messages completed per man.

MSEL--Man initials selected to perform next task.

MSG--Message position within the queue.

MSGER--Error message number.

MSGIRP(M)--Message number of interrupted message, if any, for this crewman.

MSGNO--Number of messages being processed.

MSGS--Message number index.

MSGT--Temporary storage for CMSGNO.

MSREJ(M)--Number of messages rejected per man.

MUCOMP(IH,J)--Cumulative messages completed per hour, per queue for run summary.

MUINT(IH,J)--Cumulative messages interrupted per hour per queue for run summary.

MUREJ(IH,J)--Cumulative messages rejected per hour per queue.

-N-

NAME(M)--The name or title of each man (up to four characters).

NCP(IP)- Number of tasks performed of each priority.

NCT(IT)--Number of times tasks types are completed in current iterations.

NCTSH(IH)--Number of messages performed per hour for run summary.

NCTSP(IP)--Number of task performance by priority data for run summary.

NCTST(IT)--Number of times task types completed across all iterations.

NE--Indexer for number of error messages. Used in input.

NER(MSG,J)--Number of error returns.

NERROP--Option for card input of error message.

NERT--Temporary storage for NER.

NOFAIL(M)--Number of task element failures in an hour.

NOMSG--Cumulative priority weight of messages in queue.

NOMSGS--Number of messages with a priority greater than routine which have arrived.

NOP--Indexer for number of information search options used in input.

NOPTIO--Number of information search options.

NOSUC(M)--Number of task element successes in an hour.

NR--Index for information search options.

NSHF--Current iteration number.

NSHIFT--Total number of iterations to be performed.

NSOL--Outcome from random walk, 1= solution, 2= no solution.

NSTEPS--Number of steps taken within the random work until an absorbing state is reached.

NTE--Number of task elements, total across all task analyses. Used in data input.

NTMT(IT)--Number of tasks performed by type.

NUET--Temporary storage for TNUE.

NVG--Number of vocalic control groups.

NVGM(NE)--Number of vocalic control groups for each error message.

N1--Temporary index.

N2--Temporary index.

N3--Temporary index.

N5--Temporary index.

-O-

ORO(D)--Output recording option. A value of 1 exercises the option, D= 1 for print input data, D= 2 for hourly message queue, D= 3 not used, D= 4 for detail task element processing, D= 5 for message, D= 7 for experimenter change of input data, D= 8 or 9 not used.

OUT(MSG,J)--Outcome for this message, C= completed, I= interrupted, R= rejected, blank= ready for processing when time of arrival occurs.

OUTT--Temporary storage for OUT.

-P-

PAFA--Pace adjustment factor for aspiration level.

PAFW--Pace adjustment factor for work fatigue.

PASP(M)--Permanent or initial aspiration level for each crewman. Used for reseting the aspiration level at the beginning of each iteration.

PERF(M)--The performance level of M. PERF(M)= NOSUC(M)/(NUMTRY(M) + NOFAIL(M).

PRBRT--The probability of moving closer to a solution within the random walk.

PRBWR--The probability of moving closer to a decision of no solution within the random walk.

PRIOR(MSG,J)--Message priority.

PRIORT--Temporary storage for message priority.

PROB--Temporary, adjusted, task element success probability.

PROBI(I,K,ITYP)--Probability of occurrence of task element interruption.

PROBOP(NOP)--Probability (cumulative) that each information search option will be selected for performance.

PROBCR--The probability that the solution entered to answer the error message will be correct.

PROP--Temporary variable used for numerous proportions.

PRP(IS)--Proportion of message handling time spent in each segment.

PUL--Probability of a low importance undetected error getting through to the central computer data store.

PUS--Probability of a significant error undetected error getting through to the computer data store.

-R-

RD--Pseudo random number from a uniform distribution. Mean and sigma specified by input data.

REDAM(NOP)--The ambiguity reduction factor for each information search option (0 - 1.0).

RMPS(IT)--The mean number of messages produced for each A/C received item by message type.

RY--Pseudo random number from a uniform distribution between 0 and 1.

-S-

SDACR--The standard deviation of the time required to correct a message.

SDCOR(NOP)--Standard deviation of time required to perform each information search option.

SDIN(I,K)--Standard deviation of each interruption time from incoming messages.

SEGS(CMCC,ISEG)--Time at which each message segment is completed.

SF--Stress factor.

SHFTOV--Shift completed indicator.

SIF--Success or fail indicator, S= success, F= fail.

SIGMA(I,K)--Standard deviation of the mean task element performance time - AVTIM(I,K).

SRS(M)--Average final stress per man.

SRTA--System average response time to an inquiry.

SRTS--Standard deviation of the system response time to an inquiry.

ST--Starting time for message processing.

START(M)--Actual starting time for message which was interrupted by hour and processing.

STR(M)--Current crewman stress level.

STRM(M)--The stress threshold for each man. This threshold is expressed as number of messages in the queue allocated to this man. A stress threshold of 10.0 would produce a maximum facilitory stress effect when 10 routine messages were awaiting handling. Higher priority messages are weighted to proportionally more stress producing

-T-

TARIV(MSG,J)--Time of message arrival in queue.

TARIVT--Temporary storage for TARIV.

TCORER--Total time required to respond to error message.

TIE1(MSG,M)--Total number of undetected errors of type 1.

TIE2(MSG,M)--Total number of undetected errors of type 2.

TIE3(MSG,M)--Total number of undetected errors of type 3.

TIE4(MSG,M)--Total number of undetected errors of type 4.

TIMCOR(NOP)--Average time to perform information search options.

TIME--Task element performance time.

TLEN--Intermediate value in the computation of message length.

TMIDL--Average idle time.

TMI(M)--Mean idle time.

TMINCR--Time required to input an answer to error message.

TMCOMP--Total time required within random walk for an absorbing state to be reached.

TMT(IT,IS)--Message segment times by type.

TNUE(MSG,J)--Total number of undetected errors in a message.

TMRSP--Time to perform information search option.

TPM--Time per message.

TPMC(M)--Time per message per man.

TRDEL--Transmission delay time.

TSMNSP--Total sum of means per priority in chained runs.

TSMNST--Total sum of means per message type in chained runs.

TSTEP--The time required to take each step in the random walk.

TW(IH,M)--Amount of time (seconds) worked by each crewman during each hour.

TYPE(MSG,I)--Message type for each message in the current message queue. Separate queues are kept for each type of operation -I.

TYPET--Temporary storage for type.

TZERO--Time at start of shift being simulated.

T1--Time required for message segment 1.

T2--Time required for message segment 2.

T3--Time required for message segment 3.

T4--Time required for message segment 4.

T5--Time required for message segment 5.

-U-

UE(I,P)--The probability of the occurrence of an undetected error.

UETYPE(I,P)--Undetected error type, Ta transfer.

UIOD--User of an input/output device (not FORTRAN).

-V-

V--Basic execution time function.

VCG--Vocalic central groups (not FORTRAN).

-W-

W(IC)--The relative weight of each effectiveness component in computing overall effectiveness.

WOR(M)--Mean time worked.

-X-

X--Temporary storage for ICHAIN.

X1--Mean backlog per hour in AO queue.

X2--Mean backlog for hour in UIOD queue.

X3--Mean messages completed by AO's.

X4--Mean messages completed by AIOD's.

X5--Mean number of messages rejected by AO's.

X6--Mean number of messages rejected by UIOD.

X7--Mean number of messages interrupted by AO's.

X8--Mean number of messages interrupted by UIOD's.

-Y-

Y--Number used to initialize the random number generator. An eight digit positive odd octal number must be used. This number should be changed between runs since the value, if repeated, will produce the same string of pseudo random numbers.

-Z-

Z(M)--Current time (seconds) for each crewman.

ZA--Adjusted task element success probability when stress level exceeds the stress threshold.

ZIF--Stress function for execution time.

ZIH--IH minus 1 in seconds.

ZTEST--Test value to determine which man is most available for message processing.

APPENDIX B

Program Listing

```
1*              SUBROUTINE ASPIRE
2*        C     CALCULATES ASPIRATION AND RESULTING PACE ADJUSTMENT
3*        C     FACTOR FOR THIS MAN
4*              INCLUDE COMBLK
5*              PAFA = 1.
6*              PERF(M) = ASP(M)
7*        C        CALCULATE PRESENT PERFORMANCE LEVEL
8*              A = NOSUC(M)
9*              B = NOFAIL(M)
10*             IF(( A + B) .LE. 0.) GO TO 200
11*             PERF(M) = A/(A+B)
12*       C     NO CHANGE IF PERFORMANCE ROUGHLY EQUALS ASPIRATION LEVEL
13*             IF( ABS(ASP(M) - PERF(M)) .LE. .02) GO TO 200
14*       C     IF PERFORMANCE IS LOW AND STRESS IS LOW
15*             IF (PERF(M) .GE. ASP(M) .OR. STR(M) .GE. STRM(M)) GO TO 100
16*             PAFA = 1.-.4*(ASP(M)-PERF(M))
17*             GO TO 200
18*       C     IF PERFORMANCE IS HIGH AND STRESS IS LOW
19*         100 IF (PERF(M) .LT. ASP(M) .OR. STR(M) .GE. STRM(M)) GO TO 110
20*              CALL RANDU(RY,1)
21*             ASP(M) = ASP(M)+ .1*(PERF(M)-ASP(M))*RY
22*             GO TO 200
23*       C     IF PERFORMANCE IS LOW AND STRESS IS HIGH
24*         110 IF (PERF(M) .GE. ASP(M) .OR. STR(M) .LT. STRM(M)) GO TO 120
25*             PAFA = 1.+.4*(ASP(M)-PERF(M))
26*             ASP(M) = PERF(M)
27*             GO TO 200
28*       C     IF PERFORMANCE IS HIGH AND STRESS IS HIGH
29*       C     IF (STR(M) .LT. STRM(M) .OR. PERF(M) .LE. ASP(M) GO TO 200
30*         120 STR(M) = .9*STRM(M)
31*         200 CONTINUE
32*             IF( ASP(M) .GT. 1.) ASP(M) = 1.
33*             RETURN
34*             END

***BAKLOG***      ***BAKLOG***
```

```
      SUBROUTINE BAKLOG
C        DETERMINES CHARACTERISTICS OF MESSAGES PRIOR TO SHIFT START
      INCLUDE COMBLK
      IF(ICHAIN.GE.2) GO TO 300
      IF( BKLG .LE. 0 ) GO TO 210
      J = 1
      MESS(1,J) = BKLG
      MESS(2,J) = BKLG
      DO 200 MSG = 1, BKLG
C        DETERMINE MESSAGE PRIORITY
      CALL RANDU(RY,1)
      DO 110 IP = 1,5
      IF( RY .GT. FREP(IP,1)) GO TO 110
      PRIOR(MSG,J) = IP
      GO TO 120
  110 CONTINUE
  120 CONTINUE
C        DETERMINE MESSAGE TYPE
      CALL RANDU(RY,1)
      DO 130 IT = 1,8
      IF( RY .GT. FRET(IT,1)) GO TO 130
      TYPE(MSG,J) = IT
      GO TO 140
  130 CONTINUE
  140 CONTINUE
C        DETERMINE MESSAGE LENGTH
      CALL RANDN(RY,RD,0.,1.)
      IT = TYPE(MSG,J)
      TLEN= INC(IT) + RD * INS(IT)  + .49999
      IF( TLEN .LT. (INC(IT)/10.)) TLEN = INC(IT) / 10.
      LENTH(MSG,J) = TLEN
C        FILL UP OTHER MESSAGE DESCRIPTOR SLOTS
      CMSG = CMSG + 1
      ITYC(CMSG) = IT
      IPRI(CMSG) = PRIOR(MSG,J)
      CMSGNO(MSG,J) = CMSG
C     TARTV(MSG,J) = 0.
      TARTV(MSG,J) = TZERO
```

```
*BAKLOG***      ***BAKLOG***

    39*             SEGS(CMSG, 1) = TARIV(MSG,J)
    40*             TNUE(MSG,J) = 0.
    41*             NER(MSG,J) = 0
    42*             MAN(MSG,J) = 0
    43*             OUT(MSG,J) = CHAR(11)
    44*             IFTF(MSG,J) = 0
    45*         200 CONTINUE
    46*             IF( ORO(2) .NE. CHAR(1)) GO TO 210
    47*         210 CONTINUE
    48*             DO 215  I=1,200
    49*         215  SEGS(I,7) =0.0
    50*             RETURN
    51*       C     GET QUEUE FROM LAST SHIFT
    52*         300  CONTINUE
    53*             IF(ORO(2).NE.CHAR(1)) GO TO 305
    54*             IPAGE=IPAGE+1
    55*             WRITE(2,9300) IPAGE
    56*        9300   FORMAT(1H1,40X,37HMESSAGE CORRESPONDENCE BETWEEN SHIFTS ,
    57*            1  40X,5HPAGE ,I3)
    58*             WRITE(2,9305)
    59*        9305 FORMAT(/25HOFOR ACTION OFFICER QUEUE  )
    60*         305  CALL DUMPY2
    61*             DO 330 J=1,2
    62*             II=MESS(1,J)
    63*             MSG=0
    64*             DO 315  I=1,II
    65*             IF(OUT(I,J).EQ.CHAR(14)) GO TO 315
    66*             MSG=MSG+1
    67*             CMSG=CMSG+1
    68*             ITEM=CMSGNO(I,J)
    69*             CMSGNO(MSG,J)=CMSG
    70*             ITYC(CMSG)=TYPE(I,J)
    71*             IPRT(CMSG)=PRIOR(I,J)
    72*             DO 309  N1=1,4
    73*             SEGS(CMSG,N1)=SEGS(ITEM,N1)
    74*         309  CONTINUE
    75*             TNUE(MSG,J)=TNUE(I,J)
    76*             NER(MSG,J)=NER(I,J)
    77*             MAN(MSG,J) = 0
    78*             OUT(MSG,J)=CHAR(11)
    79*             IFTF(MSG,J)=0
    80*             IF(MSG.EQ.I) GO TO 310
    81*             PRIOR(MSG,J)=PRIOR(I,J)
    82*             TYPE(MSG,J)=TYPE(I,J)
    83*             LENTH(MSG,J)=LENTH(I,J)
    84*             TARIV(MSG,J)=TARIV(I,J)
    85*         310  CONTINUE
    86*             IF(ORO(2).EQ.CHAR(1)) WRITE(2,9320) I,ITEM,MSG,CMSG
    87*        9320 FORMAT(5H MSG.,I3,7H, CMSG.,I4,15H MAPS INTO MSG.,I3,7H, CMSG.,I4)
    88*         315  CONTINUE
    89*             IF(J.EQ.1 .AND. ORO(2).EQ. CHAR(1)) WRITE(2,9310)
    90*        9310  FORMAT(//14HOFOR IOD QUEUE  )
    91*             MESS(1,J)=MSG
    92*         330  MESS(2,J)=MSG
    93*             GO TO 210
    94*             END
```

```
      SUBROUTINE CASEIN
      INCLUDE COMBLK
C        CASE MODEL DATA IS INPUTTED FROM DATA FILES HERE
      READ(9,1000) FRHR,DURIN,SDIN,DEL,DELSD
 1000 FORMAT(60F10.4)
      WRITE(2,1005)
 1005 FORMAT('1',23X, 'DURATION',14X, 'DELAY' /
     1 '  HOUR  FREQUENCY  MEAN        SD        MEAN        SD  ' /)
      DO 100 IH = 1,12
      WRITE(2,1010) IH,FRHR(IH),DURIN(IH),SDIN(IH),DEL(IH),DELSD(IH)
 1010 FORMAT(I5,5F10.4)
  100 CONTINUE
      RETURN
      END
```

CHAIN ***CHAIN***

```
OMBLK***      ***COMBLK***

  PF.COMBLK,PF.COMBLK
RLIB70 04/10-12:19:47-(13,0)
      000    QPDP,ILF *SIPSBAT.COMBLK2,*SIPSBAT.COMBLK2
      000    COMBLK  PROC
      000           INTEGER ORD, CHAR, AVAIL, PRIOR, OUT, UETYPE, END, SIF,CRIT
      000           INTEGER SHFTOV ,TYPE
      000           COMMON IPT1, IPT2, IPT3, IPT4, IPT5, IPT6
      000           REAL INC, INS, IDL
      000           INTEGER TNUE, BKLG, CMSG, CMSGNO,TIF1,TIE2,TIE3,TIE4
      000            COMMON IDENT(12), NSHIFT,  IHMAX, MEN(3), ORD(10), NSHF,
      000          2   IDAY, BKLG,  PUL, PUS, SRTA, SRTS, IATA(2,8), NTF, MPS,
      000          3   M, F(6), PREC(6), STRM(6), ASP(6), J,   SIF,
      000          4   IH, IGP(12), IGR(12), IUR(12), FRFT(7,12),
      000          5   FREP(5,12), FRER(12), FRFO(12), ITH, STR(6), MENS,
      000          6   ER(4,7), ERPG(4), EPPI(4),
      000          7   INC(7), INS(7),
      000          8   JTYPE(20,4), CRIT(20,4), END(20,4), IJF(20,4), IJS(20,4),
      000          9   AVGTM(20,4), SIGMA(20,4), AVPROB(20,4), UETYPE(20,4),UEP(20,4),
      000          1   CC12, CC13, CC14, CC23, CC24, CC34, W(4)
      000           COMMON
      000          3   MSG, PRIOR(50,2), LENTH(50,2), TYPE(50,2), TARIV(50,2),
      000          4   TNUE(50,2), NER(50,2), MAN(50,2), IFTE(50,2), OUT(50,2),
      000          6   AVAIL(6), I(6), MSGS, ST, ENDHR,  HROVER, SHFTOV, NOSUC(6),
      000          7   NOFAIL(6), LDONE, INTRPT(6), MSGTRP(6),
      000          1 TIE1(50,6),TIE2(50,6),TIE3(50,6),TIE4(50,6), PERF(6), IDL(12,6),
      000          8   MSCPL(6),MSREJ(6),MQCPL(12,6),MQREJ(12,6),MQINT(12,2),TW(12,6)
      000           COMMON PAFW, PAFA, IT, K, Y, RY,
      000          5   MESS(2,2), CMSG, CMSGNO(50,2),PASP(6)
      000           COMMON SEGS(200,7), ITYC(200), EC(12,5),ATPM, INFOLS(200),
      000          1 TMT(8,5), NTMT(8), INT(6)
      000           COMMON CTSH(12,5), NCTSH(12), CTST(8,5),
      000          1        NCTST(8), CTSP(5,5), NCTSP(5),
      000          2        CTWH(12,6),  CIDH(12,6),
      000          3        CMTMG(12,6), MGCP(12,6), CEC(12,5),
      000          4        CP(5,5), NCP(5), IPRI(200),
      000          5        CTH(12,5), NCTH(12), START(6),
      000          6        CFS(12,6), CFA(12,6),
      000          7        WOR(6), TMI(6), TPMC(6), MCL(6),
      000          8        SRS(6), ASS(6), PRP(6), CH(5),IPAGE,NAME(6),NMTYP(8)
      000           COMMON LOGBAC(12,2), MUCOMP(12,2), MUREJ(12,2), MUINT(12,2)
      000           COMMON KINKS, INFLHR(12), IREST(8,7), IRFSH(8,12),CT(8,5),NCT(8)
      000           COMMON /DATA/ CHAR(37)
      000           COMMON/DATA/ISTKNT(5),TZERO,TCHAIN,RMPS(7),AQT,AHT
      000           COMMON / DATA/ PROBI(10,3,9), AITE(10,3,9), ADI(10,3,9), ITYMAX
      000           COMMON/DATA/LINE(64),GMEANS(7),GTSMNS(12),TSMNST(7,12),
      000          1 TSMNSP(5,12), COMMNS(5), ERSUMT(7,7)
      000          2 , EXTPMH(12,6), EXASPH(12,6), EXTPM(6), EXASP(6),EXPR(2),NCC
      000          3 , ERHR(12), DURIN(12), SDIN(12), DFL(12), DELSD(12)
      000    END

   ***COMPU***      ***COMPU***
```

```
      SUBROUTINE ERROR
      INCLUDE COMBLK
      READ( 7,80) ISKIP
   80 FORMAT(I1)
      IF( ISKIP .EQ. 1) GO TO 105
      DO 100 II = 1,4
      READ(7,90) IE, (ER(IE,JE), JE= 1,7), ERPG(IE), ERPI(IE)
   90 FORMAT(I1, 7F8.2, 8X, 2F7.2)
  100 CONTINUE
  105 CONTINUE
      IF( ORO(1) .NE. CHAR(1) ) GO TO 135
C        WRITE ERROR RATE DATA
      WRITE(2,110)
  110 FORMAT( 1H ,/3X, 15HERROR FREQUENCY//
     1 23X, 12HMESSAGE TYPE,
     2 17X, 15H  ERROR RETURNS/
     34X,4HTYPE,5X,1H1,5X,1H2,5X,1H3,5X,1H4,5X,1H5,5X,1H6,5X,1H7,5X,1H8,
     46X, 2HG3, 8X, 3HIOD/)
      DO 130 IE = 1,4
      WRITE(2,120) IE, (ER(IE,JE),JE=1,7), ERPG(IE), ERPI(IE)
  120 FORMAT(1H , 4X, I2, 2X, 7F6.2, 5X,  F8.3, F10.3)
  130 CONTINUE
  135 CONTINUE
      READ(7,80) ISKIP
      IF( ISKIP .EQ. 1) GO TO 145
C        READ MESSAGE LENGTH DATA
      READ(7,140) INC, INS
  140 FORMAT( 7F10.2)
  145 CONTINUE
      IF( ORO(1) .NE. CHAR(1)) GO TO 190
C        WRITE MESSAGE LENGTH DATA
      WRITE(2,150) INC, INS
  150 FORMAT(1H //3X, 17HNO. OF CHARACTERS,
```

```
*FoROR***      ***ERROR***

     34*           1 23X, 12HMESSAGE TYPE/
     35*           2 31X,1H1,6X,1H2,6X,1H3,6X,1H4,6X,1H5,6X,1H6,6X,1H7,6X,1H8/
     36*           3 5X, 15HIN COMPUTER (M), 5X,7F7.2/
     37*           4 5X, 16HIN COMPUTER (SD), 4X,7F7.2//)
     38*            READ(7,80) ISKIP
     39*            IF( ISKIP .EQ. 1) GO TO 215
     40*            WRITE(2,170) IDENT, IPAGE
     41*       170 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
     42*            IPAGE = IPAGE + 1
     43*            WRITE(2, 180)
     44*       180 FORMAT(1H ,//9X, 18HTASK ANALYTIC DATA//
     45*           1 101X, 16HUNDETECTED-ERROR/
     46*           2 2X, 4HTASK, 5X, 7HELEMENT, 4X, 4HTYPE, 3X, 9HCRITICAL ,
     47*           3 42H  SEGMENT  NEXT-FAIL NEXT-SUCC MEAN-TIME    , 2X,
     48*           4 35HSIGMA  PROBABILITY   TYPE      PROB//)
     49*       190 CONTINUE
     50*            K = 9999
     51*     C         READS  IN TASK ANALYTIC DATA
     52*            DO 210 N = 1, NTE
     53*            READ(7,200) K,I, JTYPE(I,K), CRIT(I,K), END(I,K),
     54*           1 IJF(I,K), IJS(I,K), AVGTM(I,K), SIGMA(I,K), AVPROB(I,K),
     55*           2 UETYPE(I,K), UEP(I,K) ,INTS
     56*       200 FORMAT(I2,I3,1X,I1,A1,1X,I1,1X,2I3,2X,3F10.3,A1,F6.3,22X,I2)
     57*            IF( INTS .LE. 0) GO TO 197
     58*            READ(7,196) (ITYP, PROBI(I,K,ITYP),  AITE(I,K,ITYP),
     59*           1 ADI(I,K,ITYP), LK = 1, INTS)
     60*       196 FORMAT(4( I2, F6.3, 2F6.1))
     61*            IF( ITYP .GT. ITYMAX) ITYMAX = ITYP
     62*       197 CONTINUE
     63*            IF( ORO(1) .NE. CHAR(1)) GO TO 210
     64*            IF( K .EQ. KP) GO TO 203
     65*            KP = K
     66*            WRITE(2,202) K
     67*       202 FORMAT(1H , I5)
     68*       203 CONTINUE
     69*            WRITE(2,205)  I, JTYPE(I,K), CRIT(I,K), END(I,K),
     70*           1 IJF(I,K), IJS(I,K), AVGTM(I,K), SIGMA(I,K), AVPROB(I,K),
     71*           2 UETYPE(I,K), UEP(I,K)
     72*       205 FORMAT(5X,I10,9X,I1,8X,A1,9X,I1,2I10,F10.2,
     73*           1 F11.2,F9.3,8X,A1,F11.2)
     74*            DO 209 ITYP= 1, ITYMAX
     75*            IF( PROBI(I,K,ITYP) .LE. 0.) GO TO 209
     76*            WRITE(2,206) ITYP,  PROBI(I,K,ITYP), AITE(I,K,ITYP),
     77*           1 ADI(I,K,ITYP)
     78*       206 FORMAT(15X, 17HINTERUPTION TYPE  , I2, 15H  PROBABILITY=  ,
     79*           1 F6.3, 17H  MEAN DURATION=  , F6.1, 6H  SD= , F6.1)
     80*       209 CONTINUE
     81*       210 CONTINUE
     82*       215 CONTINUE
     83*            WRITE(2,220) (J,J= 1,8), (LD,( IATA(LD,JDA),
     84*           1 JDA = 1,8), LD= 1,2)
     85*       220 FORMAT( 1H , // 25H TASK ANALYSIS ALLOCATION,
     86*           1 / 30X,  12HMESSAGE TYPE /
     87*           2 10H OPERATOR , 8I10,
     88*           3 ( / I5, 5X, 8(9X, I1)))
     89*            READ(7,80) ISKIP
     90*            IF( ISKIP .EQ. 1) GO TO 255
```

```
      SUBROUTINE EXPER(IEND)
      INCLUDE COMBLK
      PRINT 1000
 1000 FORMAT( /20X, 'APPLIED PSYCHOLOGICAL SERVICES PRESENTS ' /
     1 / 21X,'AN ON-LINE EXPERIMENTER CONTROL OF THE' /
     2 /20X, '----------------MANMOD----------------' , /
     3 20X, 'A COMPUTER SIMULATION MODEL OF THE ARMYS' /
     5 20X, 'TOS SYSTEM RUN ON THE UNIVAC 1108 COMPUTER' /
     6 / 10X,'IN ORDER FOR THE PROGRAM TO RECEIVE YOUR INSTRUCTIONS',
     7 '  IMMEDIATELY' /7X,'SET THE CRT IN THE MESSAGE MODE' ,
     8 ' (I.E. DEPRESS BUTTON MSG.)' /
     8 / 10X, 'INSTRUCTIONS SHOULD BE INSERTED BETWEEN BRACKETS'
     8 ' WHERE INDICATED .'/
     9 /10X, 'THE XMIT BUTTON SHOULD BE DEPRESSED WHILE THE '
     9 ' THE CURSOR IS ON THE' /7X,' LINE CONTAINING THE INSTRUCTIONS.'/
     9 /10X, 'IF NO INSTRUCTIONS ARE NEEDED DEPRESS THE HOME'
     9 ' BUTTON FOLLOWED BY THE'/7X,'XMIT BUTTON.' /)
      PRINT 1005
 1005 FORMAT(
     4 10X, ' FAILURE TO POSITION THE CURSOR CORRECTLY' ,
     5 ' WILL RESULT IN' /7X, 'WRAP AROUND.  THAT IS, THE DISPLAY WILL'
     6 ' START IN THE MIDDLE THEN' /


***ERROR***      ***ERROR***

C          READ EFFECTIVENESS COMPONENT CORRELATIONS AND WEIGHTS
      READ(7,250) CC12,CC13,CC14,CC23,CC24,CC34,(W(N),N=1,4)
  250 FORMAT(10F5.3)
  255 CONTINUE
      IF(ORO(1) .NE. CHAR(1)) GO TO 270
      WRITE(2,260)CC12,CC13,CC14,CC23,CC24,CC34,(W(N),N=1,4)
  260 FORMAT(1H1, 24HEFFECTIVENESS COMPONENTS/
     1 / 2X, 31HCORRELATIONS BETWEEN COMPONENTS/
     1 3X, 6HCC12= , F5.3/
     2 3X, 6HCC13= , F5.3/
     3 3X, 6HCC14= , F5.3/
     4 3X, 6HCC23= , F5.3/
     5 3X, 6HCC24= , F5.3/
     6 3X, 6HCC34= , F5.3/
     6 / 2X, 25HWEIGHTS OF EACH COMPONENT /
     7 3X, 6HW(1)= , F5.3/
     8 3X, 6HW(2)= , F5.3/
     9 3X, 6HW(3)= , F5.3/
     1 3X, 6HW(4)= , F5.3//)
  270 CONTINUE
      RETURN
      END


***EXPER***      ***EXPER***
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*FVPER***      ***EXPER***

     23*           7 7X, 'CONTINUE ON THE TOP OF THE CRT.' /
     24*           8 / 10X, 'WHEN THE INSTRUCTIONS (IF ANY) ARE COMPLETED' ,
     25*           8 ' DEPRESS THE XMIT BUTTON.'/)
     26*            READ 2010,I
     27*          2 PRINT 1010
     28*       1010 FORMAT(22(1X/),' [  ] INDICATE THE NUMBER OF THE DATA CATEGORY',
     29*           2 ' TO BE CHANGED.'/
     30*           3 '     A RESPONSE GREATER THAN 20 WILL TERMINATE THE PROGRAM.' /
     31*           3 '     A BLANK INDICATES NO MORE CHANGES ARE TO BE MADE',
     32*           4 ' AND SIMULATION WILL START. '/
     33*           5 20X, 'DATA CATEGORIES' /
     34*           6 / '   1 NUMBER OF ITERATIONS',
     35*           7 10X, '12 MISSION TITLE' /
     36*           9 '   2 OUTPUT OPTIONS' ,
     37*           9 16X, '13 TASK ANALYSIS INDS' /
     38*           9'   3 OPERATOR TYPE DATA',
     39*           912X,'14 OPERATOR SPEED' /
     40*           9'   4 OPERATOR PRECISION' ,
     41*           912X, '15 OPERATOR THRESHOLD' /
     42*           9'   5 OPERATOR ASPIRATION' /
     43*           9'   6 MEAN TIME FOR TASKS' ,
     44*           911X, '16 SIGMA FOR TASK TIME' /     )
     45*            PRINT 1014
     46*       1014 FORMAT(
     47*           9' 7 MESSAGE ERROR RATE' ,
     48*           912X, '17 PROB-SIGNIFICANT ERROR' /
     49*           9'   8 PROB-LOW SIGNIF ERROR' ,
     50*           99X, '18 MSGS TO AO FOR HOUR' /
     51*           9'   9 MESSAGES TO AO LAST 15 MIN',
     52*           94X,'19 MSG TYPE OCCUR. RATE' /
     53*           9'  10 MSG PRIOR. OCCUR. RATE',
     54*           98X, '20 MEAN CHAR/MSG TYPE' /
     55*           9'  11 SIGMA FOR CHAR/TYPE' /)
     56*            READ 2010,I
     57*       2010 FORMAT(2X,I2)
     58*            IF( I .LE. 0) GO TO 999
     59*            IF( I .LE. 20) GO TO 5
     60*            IEND = 1
     61*            GO TO 999
     62*          5 CONTINUE
     63*            GO TO(10,20,30,40,50,60,70,80,90,100,
     64*           1 110,120,130,140,150,60,170,180,190,110),I
     65*         10 CONTINUE
     66*            PRINT 1020, NSHIFT
     67*       1020 FORMAT(22(1X/), ' [', I3, ']NUMBER OF ITERATIONS     ')
     68*            READ 2020, NSHIFT
     69*       2020 FORMAT(2X, I3)
     70*            GO TO 2
     71*     C      CHANGE IN OUTPUT RECORDING OPTIONS
     72*         20 CONTINUE
     73*            PRINT 1030, (J, ORO(J), J = 1,9)
     74*       1030 FORMAT(22(1X/),
     75*           1 ' [  ]=RECORDING OPTION   [  ]=SPECIFICATION' /
     76*           2 ' INDICATE ABOVE THE RECORDING OPTION TO BE CHANGED.'
     77*           3 /' CHANGES WILL BE REFLECTED BELOW' /
     78*           4 ' A BLANK INDICATES NO MORE CHANGES ARE TO BE MADE.' /
     79*           5 ' A SPECIFICATION OF 1 EXCERCISES THE OPTION' //
```

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*EXPER***      ***EXPER***

     80*            6 10X, 'OPTION', 10X, 'SPECIFICATION' /
     81*           7 9(10X, I3, 19X, A1 /))
     82*            READ 2030, I, J
     83*       2030 FORMAT(2X, I1, 22X, I1)
     84*            IF( I .LE. 0) GO TO 2
     85*            ORO(I) = J
     86*            GO TO 20
     87*       C       CHANGE IN CREWMAN NAME
     88*          30 CONTINUE
     89*            PRINT 1040, (M, NAME(M), M = 1,6)
     90*        1040 FORMAT( 22(1X/),
     91*           1 ' [ ]=OPERATOR NUMBER   [       ]=NEW TYPE OR NAME ' /
     92*           2  ' INDICATE ABOVE THE CHANGES FOR EACH MAN.'
     93*           3, ' CHANGES WILL BE REFLECTED BELOW.' //
     94*           4 '      OPERATOR NUMBER          NAME ' /
     95*           5 6(12X,I1,17X, A6/))
     96*            READ 2040, M, NM
     97*        2040 FORMAT(2X, I1, 21X, A6)
     98*            IF( M .LE. 0) GO TO 2
     99*            NAME(M) = NM
    100*            GO TO 30
    101*       C       CHANGE IN OPERATOR PRECISION
    102*          40 CONTINUE
    103*            PRINT 1050, (M, PREC(M), M = 1,6)
    104*        1050 FORMAT( 22(1X/),
    105*           1  ' [ ]=OPERATOR NUMBER   [      ]=PRECISION' /
    106*           2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.'/
    107*           4 ' OPERATOR          PRECISION ' /
    108*           5 6(4X, I1, 15X, F5.2/))
    109*            READ 2050, M, PR
    110*        2050 FORMAT(2X, I1, 21X, F5.1)
    111*            IF( M .LE. 0) GO TO 2
    112*            PREC(M) = PR
    113*            GO TO 40
    114*       C       CHANGE OPERATOR ASPIRATION LEVEL
    115*          50 CONTINUE
    116*            PRINT 1060, (M, ASP(M), M=1,6)
    117*        1060 FORMAT(22(1X/),
    118*           1 ' [ ]=OPERATOR NUMBER   [      ]=ASPIRATION LEVEL'/
    119*           2 ' INDICATE THE CHANGES ABOVE.'
    120*           3,' CHANGES WILL BE REFLECTED BELOW' //
    121*           4 ' CREWMAN          ASPIRATION'/
    122*           5 6(4X,I1, 15X, F5.2/))
    123*            READ 2060, M, AS
    124*        2060 FORMAT(2X, I1, 21X, F5.2)
    125*            IF( M .LE. 0) GO TO 2
    126*            ASP(M) = AS
    127*            GO TO 50
    128*       C       CHANGE MEAN TIME AND SIGMA FOR TASKS
    129*          60 CONTINUE
    130*            PRINT 1070
    131*        1070 FORMAT(22(1X/), ' [ ]INDICATE THE TASK ANALYSIS TO BE CHANGED')
    132*            READ 2070, K
    133*        2070 FORMAT(2X,I1)
    134*            IF( K .LE. 0) GO TO 2
    135*          64 PRINT 1072, K,(I,AVGTM(I,K),SIGMA(I,K),I=1,20)
    136*        1072 FORMAT(22(1X/),
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*FvPER***      ***EXPER***

    137*            1 ' [  ]=TASK ELEMENT   [       ]=MEAN   [       ]=SIGMA'/
    138*            1   7X, 'TASK ANALYSIS' , I3 /
    139*            4 3X, 'ELEMENT', 10X, 'MEAN' 8X, 'SIGMA'/
    140*            5 20(2X, I4, F18.2, F13.2/))
    141*             READ 2072, I, AVG, SIG
    142*       2072 FORMAT(2X, I2, 18X, F6.0, 10X, F6.0)
    143*             IF( I .LE. 0) GO TO 60
    144*             AVGTM(I,K) = AVG
    145*             SIGMA(I,K) = SIG
    146*             GO TO 64
    147*       C        CHANGING MESSAGE ERROR RATE
    148*          70 CONTINUE
    149*             PRINT 1080,  (L,L=1,4), (J,(ER (I,J), I = 1,4), J=1,7)
    150*       1080 FORMAT( 22(1X/),
    151*            1 ' [ ]=MESSAGE TYPE  [ ]=ERROR TYPE    '
    152*            3 '[      ]=ERROR RATE '/
    153*            4 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'///
    154*            5 10X, ' MESSAGE ERROR RATE PER 100 CHARACTERS'/
    155*            6 3X, 'MESSAGE', 17X, 'ERROR TYPE',
    156*            2/5X, 'TYPE', I9, 3I10 //
    157*            7 7(I7, F13.2, 3F10.2, 30X /)  )
    158*             READ 2080, MT, IERT, ERATE
    159*       2080 FORMAT(2X, I1, 17X, I1, 16X, F5.0)
    160*             IF( MT .LE. 0) GO TO 2
    161*             ER(IERT,MT) = ERATE
    162*             GO TO 70
    163*       C        CHANGING THE PROBABILITY OF A LOW SIGNIFICANCE ERROR
    164*          80 CONTINUE
    165*             PRINT 1090, PUL
    166*       1090 FORMAT(22(1X/),
    167*            1 ' [',E5.2,']=PROBABILITY OF A NON IMPORTANT',
    168*            2 ' ERROR IN THE COMPUTER DATA STORE')
    169*             READ 2090, PUL
    170*       2090 FORMAT(2X, F5.0)
    171*             GO TO 2
    172*       C        CHANGING THE NUMBER OF MESSAGES TO AO IN HE LAST 15 MINUTES'/
    173*          90 CONTINUE
    174*             PRINT 1100, (IH,IGP(IH),IH=1,12)
    175*       1100 FORMAT(22(1X/),
    176*            3 ' [  ]=HOUR   [    ]=NUMBER OF MESSAGES,'/
    177*            5  ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'/
    178*            7  / 6X, 'MESSAGES ARRIVING IN THE LAST 15 MINUTES OF HOUR'/
    179*            7 /10X, 'HOUR', 6X, 'NUMBER OF MESSAGES'/
    180*            8 12( 1X,I12,I16 /))
    181*             READ 2100, IH, NM
    182*       2100 FORMAT(2X, I2, 10X, I3)
    183*             IF( IH .LE. 0) GO TO 2
    184*             IGP(IH) = NM
    185*             GO TO 90
    186*       C        CHANVING MESSAGE PRIORITY OCCURRENCE RATE
    187*          100 CONTINUE
    188*             PRINT 1110, (I,I=1,5),(IH,(FREP(IP,IH),IP=1,5),IH=1,12)
    189*       1110  FORMAT(22(1X/),
    190*            1 ' [  ]=HOUR   [ ]=PRIORITY    [       ]=OCCURRENCE RATE'/
    191*            4 ' INDICATE CHANGES ABOVE.  CHANGES WILL BE REFLECTED BELOW'/
    192*            5 10X, ' MESSAGE PRIORITY OCCURRENCE RATE '
    193*            7 / 33X,     'PRIORITY' /
```

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FvPER***      ***EXPER***

  194*           8 5X, 'HOUR', I9, 4I10 //
  195*           3 12(1X,I7, F11.2, 4F10.2/))
  196*            READ 2110, IH, IP, RATE
  197*         2110 FORMAT(2X, I2, 10X, I1, 15X, F5.0)
  198*            IF( IH .LE. 0) GO TO 2
  199*            FREP(IP,IH) = RATE
  200*            GO TO 100
  201*          110 CONTINUE
  202*        C        CHANGE MEAN AND SIGMA FOR CHARACTERS PER MESSAGE TYPE
  203*            PRINT 1120, (I, INC(I), INS(I), I=1,7)
  204*         1120 FORMAT(22(1X/),
  205*             4 ' [ ]=MESSAGE TYPE   [       ]=MEAN   [       ]=SIGMA'/
  206*             5 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.'//
  207*             5 10X, 'MESSAGE LENGTH DATA'/
  208*             6 4X, 'TYPE OF', 9X, 'NUMBER OF CHARACTERS'/
  209*             7 4X, 'MESSAGE', 9X, 'MEAN', 11X, 'SIGMA' //
  210*             8 7(1X, I7, 2F16.1//))
  211*            READ 2120, MT, AMEAN, SIG
  212*         2120 FORMAT(2X, I1, 18X, F6.0, 10X,  F6.0)
  213*            IF( MT .LE. 0) GO TO 2
  214*            IF( AMEAN .GT. 0.) INC(MT) = AMEAN
  215*            IF( SIG .GT. 0.) INS(MT) = SIG
  216*            GO TO 110
  217*        C        CHANGE MISSION TITLE
  218*          120 CONTINUE
  219*            PRINT 1130, IDENT
  220*         1130 FORMAT( 22(1X/),
  221*             1 ' [', 12A6, ']'/
  222*             2 ' INSERT NEW MISSION TITLE ABOVE')
  223*            READ 2130, IDENT
  224*         2130 FORMAT(2X, 12A6)
  225*            GO TO 2
  226*        C        CHANGE TASK ANALYSIS INDICATORS
  227*          130 CONTINUE
  228*            PRINT 1140, (J,(IATA(I,J), I=1,2), J=1,7)
  229*         1140 FORMAT( 22(1X/),
  230*             1 ' [ ]=MESSAGE TYPE  [ ]=OPERATOR TYPE    ['
  231*             3 '  ]=TASK ANALYSIS' /
  232*             5' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW.'/
  233*             6 / 13X, 'TASK ANALYSIS USAGE'//
  234*             7 3X, 'MESSAGE', 10X, 'ACTION', 9X, 'UIOD'/
  235*             8 4X, 'TYPE', 11X, 'OFFICIER', 6X, 'OPERATOR'/
  236*             9 21X, '(1)',11X, '(2)'/
  237*             9 7( 1X,I5, I17, I14/))
  238*            READ 2140, MT, I, NTA
  239*         2140 FORMAT(2X,I1, 17X, I1,20X, I2)
  240*            IF( MT .LE. 0) GO TO 2
  241*            IATA(I,MT)= NTA
  242*            GO TO 130
  243*        C        CHANGE OPERATOR SPEED
  244*          140 CONTINUE
  245*            PRINT 1150,(J, F(J), J=1,6)
  246*         1150 FORMAT(22(1X/),
  247*             2 ' [  ]=OPERATOR   [       ]=SPEED'/
  248*             3 ' INDICATE ANY CHANGES ABOVE. '
  249*             3 'THE CHANGES WILL BE REFLECTED BELOW'
  250*             4  // '      OPERATOR          SPEED'/
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*EXPER***      ***EXPER***

  251*            5 6(8X, I2, 12X, F5.2/))
  252*              READ 2150, J, FJ
  253*         2150 FORMAT(2X, I2, 14X, F6.2)
  254*              IF( J .LE. 0) GO TO 2
  255*              F(J) = FJ
  256*              GO TO 140
  257*       C        CHANGE OPERATOR STRESS THRESHOLD
  258*          150 CONTINUE
  259*              PRINT 1160, (J, STRM(J), J=1,6)
  260*         1160 FORMAT(22(1X/),
  261*             2 ' [   ]=OPERATOR    [       ]=STRESS THRESHOLD'/
  262*             3 ' INDICATE ANY CHANGES ABOVE'
  263*             4 ', THE CHANGES WILL BE REFLECTED BELOW. '/
  264*             4 /'      OPERATOR          THRESHOLD' /
  265*             5 6(8X,I2,14X, F6.2 /))
  266*              READ 2160, J, ST
  267*         2160 FORMAT(2X, I2, 14X, F6.2)
  268*              IF( J .LE. 0) GO TO 2
  269*              STRM(J) = ST
  270*              GO TO 150
  271*       C        CHANGE PROBABILITY OF A SIGNIFICANT ERROR
  272*          170 CONTINUE
  273*              PRINT 1180, PUS
  274*         1180 FORMAT( 22(1X/),
  275*             1 ' [ ], F6.3, ' ]=PROBABILITY OF A SIGNIFICANT ERROR IN THE DATA ')
  276*              READ 2180, PUS
  277*         2180 FORMAT(2X, F6.3)
  278*              GO TO 2
  279*       C        CHANGE MESSAGES TO AO RANDOM THROUGH HOUR
  280*          180 CONTINUE
  281*              PRINT 1190,(IH,IGR(IH),IH=1,12)
  282*         1190 FORMAT(22(1X/),
  283*             1 ' [   ]=HOUR      [    ]=MESSAGES'/
  284*             2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
  285*             3 '      MESSAGE ARRIVAL RATE'/
  286*             4 '      HOUR         FREQUENCY'/
  287*             5 12(6X,I2,10X, I3/)                )
  288*              READ 2190, IH, IG
  289*         2190 FORMAT(2X, I2, 12X, I3)
  290*              IF( IH.LE. 0) GO TO 2
  291*              IGR(IH) = IG
  292*              GO TO 180
  293*       C        CHANGE MESSAGE TYPE OCCURRENCE RATE
  294*          190 CONTINUE
  295*              PRINT 1200, (IT,IT=1,7),(IH,(FRET(IT,IH),IT=1,7),IH=1,12)
  296*         1200 FORMAT(22(1X/),
  297*             1 ' [   ]=HOUR      [   ]=TYPE      [       ]=CUMULATIVE PROPORTION'/
  298*             2 ' INDICATE CHANGES ABOVE. CHANGES WILL BE REFLECTED BELOW'//
  299*             3 10X, 'FREQUENCY OF MESSAGE TYPES EXPRESSED AS CUMULATIVE PROPORTI
  300*             4ONS'/
  301*             5 40X, 'MESSAGE TYPE'/
  302*             6 5X, 'HOUR', 10X, 7I7/
  303*             7 12(6X, I2, 1'X, 7F7.2/))
  304*              READ 2200, IH, IT, FRE
  305*         2200 FORMAT(2X, I2, 12X, I2, 12X, F5.2)
  306*              IF( IH .LE. 0) GO TO 2
  307*              FRET(IT,IH) = FRE
```

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*FvPER***      ***EXPER***

    308*            GO TO 100
    309*      999   CONTINUE
    310*             RETURN
    311*            END
```

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     ***FATIGU***      ***FATIGU***
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      1*            SUBROUTINE FATIGU
      2*      C        CALCULATES WORK FATIGUE AS A FUNCTION OF HOUR
      3*            INCLUDE COMBLK
      4*            DAY = IDAY
      5*            PAFW = 1.1147 - .02173 * Z(M) - (DAY - 1.) * .01
      6*            PAFW = 1./ PAFW
      7*            IF(PAFW .LT. 1.) PAFW = 1.
      8*            RETURN
      9*            END
```

```
     ***HOUR***      ***HOUR***
```

```
      SUBROUTINE HOUR
C        READS IN MESSAGE BY HOUR VARIABLES
      INCLUDE COMBLK
      READ(7,40) ISKIP
   40 FORMAT(I1)
      IF( ISKIP .EQ. 1) GO TO 107
        READ(7,50) (NMTYP(IK ),IK=1,9)
   50 FORMAT(9A6)
       READ(7,60) (RMDS(L),L=1,7)
   60  FORMAT(7F5.2)
      DO 105 IHR= 1, IHMAX
      READ(7,90) IH, IGR(IH), IUR(IH),
     1 (FRET(L,IH),L=1,7),  (FREP(K,IH),K= 1,5),
     2 FREP(IH), FREQ(IH)
   90 FORMAT(4I2, 1X, 14F5.0)
      DO 100 KX = 1,7
      FRET(KX,IH) = FRET(KX,IH)/ 100.
  100 CONTINUE
      DO 102 KX = 1,5
      FREP(KX,IH) = FREP(KX,IH)/ 100.
  102 CONTINUE
  105 CONTINUE
  107 CONTINUE
      IF( QRD(1) .NE. CHAR(1)) GO TO 200
      WRITE(2,108) (RMDS(L),L=1,7)
  108  FORMAT(//32HMESSAGES PER STIMULUS BY TYPE   /
     1 43H      1      2      3      4      5      6      7 /1X,7F6.2)
      WRITE(2,110)
  110 FORMAT(1H ,/25H           HOUR PARAMETERS,
     1 / 26X, 41H-------INPUT MESSAGES FROM OUTSIDE------- ,
     2 // 46H              CUMULATIVE MESSAGE FREQUENCY BY TYPE,
     3 33H        CUM. MSG FREQ. BY PRIORITY ,
     4 46H     DELIVERIES PER HOUR     NUMBER OF MESSAGES ,
     5 / 48H      HOUR   1     2     3     4     5     6     7     8 ,
     6 30H          1     2     3     4     5 ,
     7 50H        ROUTINE  NOT-ROUTINE  LAST 1/4 HR  ANYTIME  /)
      DO 130 IHR= 1, IHMAX
      WRITE(2,120) IH,
```

```
*HOUR***      ***HOUR***

     39*           1 (FRFT(L,IH),L= 1,7),(FREP(K,IH), K= 1,5), FRER(IH), FREQ(IH),
     40*           2 IGP(IH), IGR(IH)
     41*         120 FORMAT(1H , I8, 1X, 7F5.2, 9X, 5F5.2, F13.1, F11.1, 2I11)
     42*         130 CONTINUE
     43*         200 CONTINUE
     44*             IF(ORO(9) .NE. CHAR(2)) GO TO 999
     45*             DO 900 IHH=1,IHMAX
     46*             READ(7,1000) IH,FRHR(IH),DURIN(IH),SDIN(IH),DEL(IH),DELSD(IH)
     47*        1000 FORMAT(I2,5F10.4)
     48*             IF(IH .GT. 0) GO TO 900
     49*             WRITE(2,1100)
     50*        1100 FORMAT(' ZERO HOUR IN CASE TYPE DATA HAS BOMBED RUN')
     51*         900 CONTINUE
     52*             WRITE(2,1005)
     53*        1005 FORMAT('1', 23X, 'DURATION', 14X, 'DELAY' /
     54*            1 '  HOUR  FREQUENCY  MEAN        SD        MEAN        SD'//)
     55*             DO 950 IH = 1,IHMAX
     56*             WRITE(2,1010) IH,FRHR(IH), DURIN(IH),SDIN(IH),DEL(IH),DELSD(IH)
     57*        1010 FORMAT(I5,5E10.4)
     58*         950 CONTINUE
     59*         999 CONTINUE
     60*             RETURN
     61*             END

     ***ITSUM***      ***ITSUM***
```

```
      SUBROUTINE ITSUM
C        PRINTS SHIFT RESULTS
      INCLUDE COMBLK
      IF( ORO(6) .NE. 1) GO TO 12
      WRITE(2,4) IDENT, IPAGE
    4 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
      IPAGE = IPAGE + 1
      WRITE(2,5) NSHF
    5 FORMAT(1H , / 28H  RESULTS OF SHIFT ITERATION, I5/)
      WRITE(2,10)(IH,(EC(IH,KL),KL=1,5), IH= 1,IHMAX)
   10 FORMAT(1H , //10X, 41HTHOROUGHNESS COMPLETENESS RESPONSIVENESS ,
     1  22HACCURACY EFFECTIVENESS/
     2 6H  HOUR/
     3 ( I5, 5F12.2/))
   12 CONTINUE
      DO 15 IT = 1,7
      X = NCT(IT)
      IF( X .LE. 0) GO TO 15
      NCTST(IT) = NCTST(IT) + NCT(IT)
      DO 14 IS = 1,5
C        STORE CUMULATIVE TIME SEGMENTS BY TYPE FOR RUN SUMMARY
      CTST(IT,IS) = CTST(IT,IS) + CT(IT,IS)
C        CALCULATE ITERATION MEAN TIME PER SEGMENT PER TYPE
      CT(IT,IS) = CT(IT,IS) / X
   14 CONTINUE
   15 CONTINUE
      DO 17 IP = 1,5
      X = NCP(IP)
      IF( X .LE. 0) GO TO 17
C        ACCUMULATE TIME SEGMENTS BY PRIORITY FOR RUN SUMMARY
      NCTSP(IP) = NCP(IP) + NCTSP(IP)
      DO 16 IS = 1,5
      CTSP(IP,IS) = CTSP(IP,IS) + CP(IP,IS)
      CP(IP,IS) = CP(IP,IS) / X
   16 CONTINUE
   17 CONTINUE
      IF( ORO(6) .NE. 1) GO TO 30
      WRITE(2,20) (IT, NCT(IT), (CT(IT,IS), IS= 1,5), IT= 1,7)
   20 FORMAT(1H , //10X, 80H          NO.          T1           T2
```

```
      1*
      2*            INCLUDE COMBLK,LIST
      2*      COMBLK  PROC
      2*            INTEGER ORO, CHAR, AVAIL, PRIOR, OUT, UETYPE, END, SIF,CRIT
      2*            INTEGER SHFTOV ,TYPE
      2*            COMMON IPT1, IPT2, IPT3, IPT4, IPT5, IPT6
      2*            REAL INC, INS, IDL
      2*            INTEGER TNUE, BKLG, CMSG, CMSGNO,TIE1,TIE2,TIE3,TIE4
      2*             COMMON IDENT(12), NSHIFT,  IHMAX, MEN(3), ORO(10), NSHF,
      2*           2   IDAY, BKLG,  PUL, PUS, SRTA, SRTS, IATA(2,8), NTF, MPS,
      2*           3   M, F(6), PREC(6), STRM(6), ASP(6), J,   SIF,
      2*           4   TH, IGP(12), IGR(12), IUR(12), FRET(7,12),
      2*           5   FREP(5,12), FRER(12), FREO(12), ZTH, STR(6), MENS,
      2*           6   ER(4,7), ERPG(4), EPPT(4),
      2*           7   INC(7), INS(7),
      2*           8   JTYPE(20,4), CRIT(20,4), END(20,4), IJE(20,4), IJS(20,4),
      2*           9   AVGTM(20,4), SIGMA(20,4), AVPROB(20,4), UETYPE(20,4),UEP(20,4),
      2*           1   CC12, CC13, CC14, CC23, CC24, CC34, W(4)
      2*            COMMON
      2*           3   MSG, PRIOR(50,2), LENTH(50,2), TYPE(50,2), TARIV(50,2),
      2*           4   TNUE(50,2), NER(50,2), MAN(50,2), TETE(50,2), OUT(50,2),
      2*           6   AVAIL(6), Z(6), MSGS, ST, ENDHR,  HROVER, SHFTOV, NOSUC(6),
      2*           7   NOFAIL(6), LOONE, INTRPT(6), MSGTRP(6),
      2*           1 TIE1(50,6),TIE2(50,6),TIE3(50,6),TIE4(50,6), PERF(6), TDL(12,6),
      2*           8   MSCPL(6),MSREJ(6),MQCPL(12,6),MQREJ(12,6),MQINT(12,2),TW(12,6)
      2*            COMMON PAEW, PAEA, IT, K, Y, RY,
      2*           5   MESS(2,2), CMSG, CMSGNO(50,2),PASP(6)
      2*            COMMON SEGS(200,7), TTYC(200), EC(12,5),ATPM, INFOLS(200),


*ITSUM***      ***ITSUM***

     40*           1  T3           T4           T5
     41*           2 154    TYPE  CMPL./
     42*           2 ( I7, I15,  5E12.1/))
     43*         30 CONTINUE
     44*            DO 50 IH = 1, IHMAX
     45*            DO 51 L = 1,2
     46*            MUINT(IH,L) = MUINT(IH,L) + MQINT(IH,L)
     47*         51 CONTINUE
     48*            DO 50 M = 1, MENS
     49*            J = 1
     50*            IF( M .GT. MEN(1)) J = 2
     51*            MUCOMP(IH,J) = MUCOMP(IH,J) + MQCPL(IH,M)
     52*            MUREJ(IH,J) = MUREJ(IH,J) + MQREJ(IH,M)
     53*         50 CONTINUE
     54*            IF(ICHAIN.NE.0) CALL DUMPY1
     55*            RETURN
     56*            END


***MAIN***      ***MAIN***
```

```
*MAIN***      ***MAIN***

      2*              INCLUDE COMBLK
      3*              DATA(((AITE(I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
      4*              DATA(((ADI (I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
      5*              DATA(((PROBI(I,J,K),I=1,10),J=1,3),K=1,9)/270*0.0/
      6*              DATA (CHAR(I),I=1,37) /
      7*             1 1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9, 1H0, 1H ,
      8*             2 1HA, 1HB, 1HC, 1HD, 1HE, 1HF, 1HG, 1HH, 1HI, 1HJ, 1HK,
      9*             3 1HL, 1HM, 1HN, 1HO, 1HP, 1HQ, 1HR, 1HS, 1HT, 1HU, 1HV, 1HW,
     10*             4 1HX, 1HY, 1HZ /
     11*                DATA (FRHR(I),I=1,12)/12 * 0.0/
     12*              IPAGE = 1
     13*           10 CONTINUE
     14*              CALL SIMPAM
     15*              IF( ICHAIN .EQ. 1) CALL CHAIN
     16*              CALL PEOPLE
     17*              CALL HOUR
     18*              CALL ERROR
     19*              IEND = 0
     20*           15 CONTINUE
     21*              IF( ORO(7) .EQ. CHAR(1)) CALL EXPER(IEND)
     22*              IF( IEND .EQ.1) GO TO 999
     23*              IF(ORO(9) .EQ. CHAR(1)) CALL CASEIN
     24*              IF( ORO(8) .EQ. CHAR(1)) CALL COMPU
     25*              DO 140 NSHF = 1,NSHIFT
     26*        C     SUBROUTINE RESET PREPARES CONDITIONS FOR START OF
     27*           30 CALL RESET
     28*        C     NEW SHIFT
     29*           40 CALL BAKLOG
     30*           60 CALL MESGEN
     31*              CALL MANDET
     32*              CALL RESHR
     33*              IF( SHFIOV .EQ. CHAR(36)) GO TO 130
     34*              GO TO 60
     35*        C        ALL MESSAGE PROCESSING IS HANDLED IN HERE
```

```
*MAIN***      ***MAIN***

    36*         130 CALL ITSUM
    37*       C     PRINTS OUT SHIFT RESULTS
    38*         140 CONTINUE
    39*       C         RUN ANALYSIS
    40*       C     PRINTS SHIFT SUMMARY ACROSS ITERATIONS
    41*
    42*             CALL RUNSUM
    43*             READ(7,160) IREP
    44*         160 FORMAT( I1)
    45*             IF( IREP .EQ. 1 ) GO TO 10
    46*         150 CONTINUE
    47*             IF(ICHAIN.NE.0) CALL TOTIT
    48*             IF( ORO(7) .EQ. CHAR(1)) CALL SUMMER
    49*             IF( ORO(7) .EQ. CHAR(1)) GO TO 15
    50*         999 CONTINUE
    51*             END FILE 2
    52*             END


***MANDET***      ***MANDET***


     1*             SUBROUTINE MANDET
     2*       C     SELECTS MAN AND MESSAGE TO PROCESS AS WELL
     3*       C     AS DETERMINING WHEN HOUR IS OVER EITHER DUE
     4*       C     TO ALL MESSAGES COMPLETED OR ALL MEN FINISHED
     5*             INCLUDE COMBLK
     6*          10 CONTINUE
     7*       C        FORCE COMPLETION OF ALL INTERUPTED MESSAGES FIRST
     8*             IF( KINKS .LE. 0 ) GO TO 19
     9*             DO 15 MINT = 1, MENS
    10*             IF( INTRPT(MINT) .NE. 1) GO TO 15
    11*             KINKS = KINKS - 1
    12*             MSEL = MINT
    13*             M = MINT
    14*             GO TO 80
    15*          15 CONTINUE
    16*          19 CONTINUE
    17*       C     CHECK IF ALL MEN HAVE FINISHED OUT THE HOUR
    18*             IF (LDONE .GE. MENS) GO TO 500
    19*          20 CONTINUE
    20*       C     SELECT THE MAN WITH LOWEST TIME USED WHO IS AVAILABLE
    21*             ZTEST=360000.
    22*             DO 30 M=1, MENS
    23*             IF (AVAIL(M) .NE. CHAR(1) .OR. Z(M) .GE. ZTEST) GO TO 30
    24*             ZTEST = Z(M)
    25*             MSEL = M
    26*          30 CONTINUE
    27*             M = MSEL
    28*             IF( INTRPT(M) .EQ. 1 ) GO TO 80
    29*       C     IF G3 WAS SELECTED, SEE IF OTHERS ARE WORKING AND
    30*       C     MESSAGE PRIORITY IS GREATER THAN 1
    31*          35 CONTINUE
    32*             IF (MSEL .NE. MEN(1)) GO TO 80
```

```
*MANDET***      ***MANDET***

      C        SET UP G3 QUEUE FOR REVIEW/
           MS = MESS (1,1)
           DO 70 MSG = 1,MS
           IF (PRIOR(MSG,1) .LT. 2 .OR. OUT(MSG,1) .NE. CHAR(11)) GO TO 70
           IF (Z(MSEL) - TARIV(MSG,1)) 40,80,80
        40 IDL(IH,MSEL) = IDL(IH,MSEL) - Z(MSEL) + TARIV(MSG,1)
           Z(MSEL) = TARIV(MSG,1)
           IF( Z(MSEL) .LT. ENDHR) GO TO 20
           LDONE = LDONE + 1
           AVAIL(MSEL) = CHAR(11)
           GO TO 19
        70 CONTINUE
      C    IF THIS POINT IS REACHED THESE ARE NO MESSAGES WORTHY
      C    OF G3S ATTENTION
           LDONE = LDONE + 1
           AVAIL(MSEL) = CHAR(11)
           DIF = 3600. - IDL(IH,MSEL) - TW(IH,MSEL)
           IDL(IH,MSEL) = IDL(IH,MSEL) + DIF
           Z(MSEL) = ZIH + 3600.
           GO TO 10
        80 CONTINUE
      C       SET J TYPE OF OPERATOR SIMULATED
           J = 2
           IF (MSEL .LE. MEN(1)) J = 1
           IF( INTRPT(M) .EQ. 1 ) GO TO 200
      C       ARE THERE ANY MESSAGES LEFT IN THIS QUEUE
           IF (MESS(2,J) .GT.0) GO TO 200
      C    IF NOT CLOSE OUT THE HOUR FOR ALL OPERATORS OF THIS TYPE
        85 CONTINUE
           IF (J .EQ.2) GO TO 90
           IS = 1
           IFN = MEN(1)
           GO TO 100
        90 CONTINUE
      C       BEFORE CLOSING OUT IOD FOR HOUR, SEE IF G3-A0 FINESHED
           IF(MESS(2,1) .LE. 0) GO TO 95
           MC = 0
           MS = MEN(1)
           DO 92 MA = 1, MS
           IF( AVAIL(MA) .NE. CHAR(1))  MC = MC + 1
        92 CONTINUE
           IF( MS - MC) 95, 95, 93
        93 CONTINUE
           ZTEST  = 360000.
           DO 94 MA = 1, MS
           IF( AVAIL(MA) .NE. CHAR(1) .OR. Z(M) .GE. ZTEST) GO TO 94
           ZTEST = Z(M)
           MSEL = MA
           M = MSEL
        94 CONTINUE
           GO TO 85
        95 CONTINUE
           IS = MEN(1) + 1
           IFN = MEN(1) + MEN(2)
       100 CONTINUE
           DO 110 M = IS,IFN
           IDL(IH,M) =      + 3600. - TW(IH,M)
```

```
*MANDET***      ***MANDET***

     90*              AVAIL(M) = CHAR(11)
     91*              IF (Z(M) .LT. ZIH + 3600.)LDONE = LDONE+1
     92*              IF( Z(M) .LT. (ZIH + 3600. )) Z(M) = ZIH + 3600.
     93*          110 CONTINUE
     94*              GO TO 10
     95*        C     CHECK IF THIS MAN HAS AN INTERUPTED MESSAGE TO COMPLETE
     96*          200 CONTINUE
     97*              IF (INTRPT(M) .NE. 1) GO TO 210
     98*              MSG = MSGIRP(M)
     99*              KM = MESS(1,J)
    100*              DO 205 KL = 1, KM
    101*              IF( CMSGNO(KL,J) .NE. MSG) GO TO 205
    102*              MSG = KL
    103*              GO TO 207
    104*          205 CONTINUE
    105*              WRITE(2,206) MSG,J,M
    106*          206 FORMAT(1H1, 19HCUMULATIVE MESSAGEE,T10, 17H  NOT IN QUEUE N,,
    107*             1 I4, 8HFOR MAN , I4)
    108*          207 CONTINUE
    109*              INTRPT(M) = 0
    110*              MSGIRP(M) = 0
    111*              GO TO 400
    112*          210 CONTINUE
    113*        C        SELECT NEXT MESSAGE TO PROCESS
    114*              MS = MESS (1,J)
    115*              MSGTEM = 0
    116*              NOMSG = 0
    117*              DO 250 ML = 1,MS
    118*              IF (QUT(ML,J) .NE. CHAR(11)) GO TO 250
    119*              IF (TARIV(ML,J) .GT. Z(M)) GO TO 260
    120*        C     IF( PRIOR(ML,J) .GT. CHAR(1)) NOMSG = NOMSG + 1
    121*              ITEM=PRIOR(ML,J)
    122*              NOMSG=NOMSG+ ISTKNT(ITEM)
    123*              IF (MSGTEM.LE.0) MSGTEM = ML
    124*              IF( PRIOR(ML,J) .LE. PRIOR(MSGTEM,J)) GO TO 250
    125*              MSGTEM = ML
    126*          250 CONTINUE
    127*              IF(MSGTEM.LE. 0 ) GO TO 85
    128*              MSG = MSGTEM
    129*              GO TO 300
    130*          260 CONTINUE
    131*              IF(MSGTEM.LE. 0) GO TO 265
    132*              MSG = MSGTEM
    133*              GO TO 300
    134*          265 CONTINUE
    135*        C     IF NO MESSAGE HAS ARRIVED YET
    136*              MSG = ML
    137*              GO TO 300
    138*          270 CONTINUE
    139*          280 CONTINUE
    140*          300 CONTINUE
    141*              IF( TARIV(MSG,J) .GE. (ZIH + 3600.) .AND. J .EQ. 2) GO TO 95
    142*              IF( TARIV(MSG,J) .GE. ENDHR)  GO TO 85
    143*        C     IS THE SELECTED OPERATOR READY TO PROCESS THE MESSAGE
    144*              IF( INTRPT(M) .EQ. 1 ) GO TO 400
    145*              IF (Z(M) .GE. TARIV(MSG,J)) GO TO 310
    146*        C     IF NOT HE IDLES UNTIL MESSAGE ARRIVES
```

```
*MANDET***      ***MANDET***

    147*            IDL(IH,M) = IDL(IH,M) + TARIV(MSG,J) - Z(M)
    148*            IF( IDL(IH,M) .GT. 3600.) WRITE(2,305) IDL(IH,M), MSG, Z(M), M
    149*        305 FORMAT(1H , 29HIN WAIT FOR MESSAGE IDLE IDL=, F10.2,
    150*           1 7H  MSG= , I5, 8H  TIME= , F10.2, 8HFOR MAN , I5)
    151*            Z(M) = TARIV(MSG,J)
    152*            GO TO 320
    153*        310 CONTINUE
    154*        320 CONTINUE
    155*        340 CONTINUE
    156*        350 CONTINUE
    157*      C     COMPUTE STRESS LEVEL BASED ON NUMBER OF MESSAGES
    158*      C     IN QUEUE, NUMBER OF OPERATORS, AND STRESS THREASHOLD
    159*            A = NOMSG
    160*            B = MEN(J)
    161*            STR(M) = A/B
    162*      C     DOES STRESS EXCEED THE THREASHOLD LEVEL
    163*            IF(STR(M) .LT. STRM(M)) GO TO 400
    164*            IF (PRIOR(MSG,J) .NE. 1        .OR. J .NE. 2) GO TO 400
    165*            OUT(MSG,J) =  CHAR(29)
    166*        400 CONTINUE
    167*            CALL ASPIRE
    168*      C     CALCULATES ASPIRATION AND RESULTING PACE ADJUSTMENT FACTOR
    169*            CALL FATIGU
    170*      C     CALCULATES WORK FATIGUE
    171*            CALL PROC
    172*            GO TO 10
    173*        500 CONTINUE
    174*      C        HOUR IS COMPLETED
    175*            HROVER = CHAR(36)
    176*             RETURN
    177*            END

     ***MESGEN***      ***MESGEN***
```

```
      SUBROUTINE MESGEN
C        CREATES MESSAGE QUEUES INCLUDING MERGING BACKLOG
      INCLUDE COMBLK
      IC = 1
      J = 1
      LZ = MESS(1,J)
      DO 200 MSG = 1, LZ
C        MESSAGES COMPLETED ARE ZEROED OUT
      IF( OUT(MSG,J) .EQ. CHAR(14))  GO TO 100
      IF( IC .EQ. MSG) GO TO 190
C        MESSAGES INCOMPLETE WILL BE MOVED TO THE BOTTOM OF THE QUEUE IF
C        THEY ARE NOT ALREADY THERE
      PRIOR(IC,J) = PRIOR(MSG,J)
      LENTH(IC,J) = LENTH(MSG,J)
      TYPE(IC,J) = TYPE(MSG,J)
      TARIV(IC,J) = TARIV(MSG,J)
      TNUE(IC,J) = TNUE(MSG,J)
      NER(IC,J) = NER(MSG,J)
      MAN(IC,J) = MAN(MSG,J)
      IFTE(IC,J) = IFTE(MSG,J)
      OUT( IC,J) = OUT(MSG,J)
      CMSGNO(IC,J) = CMSGNO(MSG,J)
      IF(OUT(IC,J) .EQ. CHAR(29)) OUT(IC,J) = CHAR(11)
      IC = IC + 1
  100 CONTINUE
      PRIOR(MSG,J) = CHAR(11)
      LENTH(MSG,J) = 0
C     TARIV(MSG,J) = 0.
      TARIV(MSG,J) = TZERO
      TNUE(MSG,J) = 0
```

```
*MESGEN***      ***MESGEN***

     31*            NER(MSG,J) = 0
     32*            MAN(MSG,J) = CHAR(11)
     33*            IFTE(MSG,J) = 0
     34*            OUT(MSG,J) = CHAR(11)
     35*            GO TO 200
     36*          190 CONTINUE
     37*            IC = IC + 1
     38*          200 CONTINUE
     39*            LOGRAC(IH,1)  = IC - 1  + LOGRAC(IH,1)
     40*      C        IC - 1  IS EQUAL TO THE NUMBER OF MESSAGES IN THE QUEUE
     41*            ICF = IC - 1 + IGR(IH) + IGR(TH)
     42*            MSG=IC-1
     43*            IF(( IGR(IH) + IGR(IH)) .LE. 0) GO TO 310
     44*            DO 300 II=IC,ICF
     45*             MSG=MSG+1
     46*      C        DETERMINE MESSAGE TYPE
     47*            CALL RANDU(RY,1)
     48*            DO 240 IT= 1,7
     49*            IF(RY .GT. FRET(IT,IH)) GO TO 240
     50*            TYPE(MSG,J) = IT
     51*            GO TO 250
     52*          240 CONTINUE
     53*          250 CONTINUE
     54*      C      DETERMINE NUMBER OF MESSAGES FROM STIMULUS
     55*             CALL POIS(RMPS(IT),Y,KK)
     56*             IF(KK.LE.0) KK=1
     57*      C        DETERMINE MESSAGE TIME OF ARRIVAL
     58*            CALL RANDU(RY,1)
     59*            IF(MSG .GT. (IC -1 +  IGR(IH))) GO TO 260
     60*            IF( TYPE(MSG,J) .NE. CHAR(5)) GO TO 255
     61*             X=ZIH+RY*3600.0
     62*            GO TO 270
     63*      C        FREQUENCY OF ARRIVAL IS USED HERE TO DETERMINE MESSAGE BUNCH TI
     64*          255 CONTINUE
     65*            FR = FRER(IH)
     66*            IF(IP .GT. 1) FR = FREQ(TH)
     67*            CALL RANDU(RY,1)
     68*            FT= RY * FR + .49999
     69*            IF = FT
     70*            FT= IF
     71*            X= ZIH +(FT / (FR+1.0) ) * 3600.
     72*            GO TO 270
     73*          260  X=ZIH+ 2700. + RY*900.
     74*          270 CONTINUE
     75*      C      BUILD MESSAGES
     76*            DO 290 JJ=1,KK
     77*            IF(JJ.EQ.1) GO TO 230
     78*            MSG=MSG+1
     79*      C      DETERMINE MESSAGE TYPE
     80*            CALL RANDU(RY,1)
     81*             DO 1240 IT=1,7
     82*             IF(RY.GT.FRET(IT,IH)) GO TO 1240
     83*             TYPE(MSG,J) =IT
     84*             GO TO 1250
     85*         1240 CONTINUE
     86*         1250  CONTINUE
     87*          230  TARIV(MSG,J)=X
```

```
*MESGEN***      ***MESGEN***

     88*      C        DETERMINE MESSAGE PRIORITY
     89*              CALL RANDU(RY,1)
     90*              DO 210 IP = 1,5
     91*              IF(RY .GT. PREP(IP,IH)) GO TO 210
     92*              PRIOR(MSG,J) = IP
     93*              GO TO 220
     94*          210 CONTINUE
     95*          220  CONTINUE
     96*      C        DETERMINE MESSAGE LENGTH
     97*              CALL RANDN (RY,RD,0,1)
     98*              IT = TYPE(MSG,J)
     99*              TLEN     = INC(IT) + RY * INS(TT) + .4999
    100*              IF( TLEN .LT. (INC(IT)/10.)) TLEN= INC(IT) / 10.
    101*              LENTH(MSG,J) = TLEN
    102*              CMSG = CMSG + 1
    103*              ITYC(CMSG) = TYPE(MSG,J)
    104*              IPRI(CMSG) = PRIOR(MSG,J)
    105*              SEGS(CMSG,1) = TARIV(MSG,J)
    106*              CMSGNO(MSG,J) = CMSG
    107*              TNUE(MSG,J) = 0.
    108*              NER(MSG,J) = 0
    109*              MAN(MSG,J) = CHAR(11)
    110*              IFTE(MSG,J) = 0
    111*              OUT(MSG,J) = CHAR(11)
    112*              IF(MSG.GE.50) GO TO 310
    113*          290  CONTINUE
    114*          300 CONTINUE
    115*          310  ICE=MSG
    116*              MESS(1,1) = ICE
    117*              MESS(2,1) = ICE
    118*      C        SET QUEUE IN ORDER OF MESSAGE ARRIVAL
    119*              DO 400 MSG = 1, ICE
    120*              MC = MSG + 1
    121*              IF( MC .GT. ICE) GO TO 400
    122*              DO 390 MG = MC, ICE
    123*              IF(TARIV(MSG,J) .LT. TARIV(MG,J)) GO TO 390
    124*              IF(TARIV(MSG,J) .EQ. TARIV(MG,J) .AND. PRIOR(MSG,J) .GE.
    125*             1 PRIOR(MG,J)) GO TO 390
    126*              PRIORT = PRIOR(MSG,J)
    127*              LENTHT = LENTH(MSG,J)
    128*              TYPET = TYPE(MSG,J)
    129*              TARIVT = TARIV(MSG,J)
    130*              CMSGT = CMSGNO(MSG,J)
    131*              PRIOR(MSG,J) = PRIOR(MG,J)
    132*              LENTH(MSG,J) = LENTH(MG,J)
    133*              TYPE(MSG,J) = TYPE(MG,J)
    134*              TARIV(MSG,J) = TARIV(MG,J)
    135*              CMSGNO(MSG,J) = CMSGNO(MG,J)
    136*              PRIOR(MG,J) = PRIORT
    137*              LENTH(MG,J) = LENTHT
    138*              TYPE(MG,J) = TYPET
    139*              TARIV(MG,J) = TARIVT
    140*              CMSGNO(MG,J) = CMSGT
    141*          390 CONTINUE
    142*          400 CONTINUE
    143*              IF( ORO(2) .NE. CHAR(1) ) GO TO 435
    144*      C        WRITE OUT 40-63 HOUR QUEUE
```

```
*MESGFN***      ***MESGFN***

    145*            WRITE(2, 405) IDENT, IPAGE
    146*        405 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
    147*            IPAGE = IPAGE + 1
    148*            WRITE(2,410) IH
    149*        410 FORMAT(1H , 9X, 43HMESSAGES GENERATED OR CARRIED OVER FOR HOUR,I5,
    150*           1 8H  FOR G3//
    151*           2 47H ORDER    ARRIVED   PRIORITY    TYPE     LENGTH,
    152*           2 62H   OUTCOME    TOTAL     ERROR        INTERUPTED     CUMULATIVE
    153*           3/11X, 5H(SEC), 43X, 18HUNDET ERR  RETURNS,
    154*           4 5X, 25HMAN     ELEMENT   MSG NO//)
    155*            DO 430 MSG = 1,ICF
    156*            WRITE(2,420) MSG, TARIV(MSG,J), PRIOR(MSG,J), TYPE(MSG,J),
    157*           1LENTH(MSG,J), OUT(MSG,J), TNUE(MSG,J), NER(MSG,J), MAN(MSG,J),
    158*           3 IFTE(MSG,J), CMSGNO(MSG,J)
    159*        420 FORMAT(1H , I4, F13.1, 6X, I1, 9X, I1, I12, 7X, A1, I11,
    160*           1 I9, 9X, I1, I10, I12)
    161*        430 CONTINUE
    162*        435 CONTINUE
    163*            IC = 1
    164*            J = 2
    165*            IF(MESS(1,J) .LE. 0) GO TO 580
    166*            LZ = MESS(1,J)
    167*            DO 500 MSG = 1, LZ
    168*      C        MESSAGES COMPLETED ARE ZEROED OUT
    169*            IF( OUT(MSG,J) .EQ. CHAR(14)) GO TO 490
    170*      C        MESSAGES INCOMPLETE WILL BE MOVED TO THE BOTTOM OF THE QUEUE IF
    171*      C        THEY ARE NOT ALREADY THERE
    172*            IF( IC .EQ. MSG) GO TO 495
    173*            PRIOR(IC,J) = PRIOR(MSG,J)
    174*            LENTH(IC,J) = LENTH(MSG,J)
    175*            TYPE(IC,J) = TYPE(MSG,J)
    176*            TARIV(IC,J) = TARIV(MSG,J)
    177*            TNUE(IC,J) = TNUE(MSG,J)
    178*            NER(IC,J) = NER(MSG,J)
    179*            MAN(IC,J) = MAN(MSG,J)
    180*            IFTE(IC,J) = IFTE(MSG,J)
    181*            OUT( IC,J) = OUT(MSG,J)
    182*            CMSGNO(IC,J) = CMSGNO(MSG,J)
    183*            IF(OUT(IC,J) .EQ. CHAR(29)) OUT(IC,J) = CHAR(11)
    184*            IC = IC + 1
    185*        490 CONTINUE
    186*            PRIOR(MSG,J) = 0
    187*            LENTH(MSG,J) = 0
    188*            TYPE(MSG,J) = 0
    189*      C     TARIV(MSG,J) = 0.
    190*            TARIV(MSG,J) = TZERO
    191*            TNUE(MSG,J) = 0
    192*            NER(MSG,J) = 0
    193*            MAN(MSG,J) = 0
    194*            IFTE(MSG,J) = 0
    195*            OUT(MSG,J) = CHAR(11)
    196*            GO TO 500
    197*        495 IC = IC + 1
    198*        500 CONTINUE
    199*            IC = IC - 1
    200*            LOGBAC(IH,2) = IC  + LOGBAC(IH,2)
    201*            MESS(1,J) = IC
```

```
*MESGEN***      ***MESGEN***

    202*            MESS(2,J) = IC
    203*            IF( ORD(2) .NE. CHAR(1) ) GO TO 580
    204*            IF( IC .LE. 0 ) GO TO 580
    205*            WRITE(2, 540 ) IDENT, IPAGE
    206*        540 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
    207*            IPAGE = IPAGE + 1
    208*            WRITE(2,550)
    209*        550 FORMAT( 1H , 9X, 23HTOD STARTING HOUR QUEUE//
    210*           2 47H ORDER    ARRIVED   PRIORITY    TYPE     LENGTH,
    211*           2 62H   OUTCOME    TOTAL     ERROR         INTERUPTED     CUMULATIVE
    212*           3/11X, 5H(SEC), 43X, 18HUNDET ERR  RETURNS,
    213*           4 5X, 25HMAN      ELEMENT   MSG NO//)
    214*            DO 570 MSG = 1, IC
    215*            WRITE(2,560) MSG, TARIV(MSG,J), PRIOR(MSG,J), TYPE(MSG,J),
    216*           1LENTH(MSG,J), OUT(MSG,J), TNUE(MSG,J), NER(MSG,J), MAN(MSG,J),
    217*           3 IFTE(MSG,J), CMSGNO(MSG,J)
    218*        560 FORMAT(1H ,I4,F13.1,6X,I1,9X,I1,I12,7X,A1,I11,
    219*           1 I9, 9X, I1, I10, I12)
    220*        570 CONTINUE
    221*        580 CONTINUE
    222*            RETURN
    223*            END

    ***PEOPLE***      ***PEOPLE***
```

```
 1*            SUBROUTINE PEOPLE
 2*      C        READS IN PERFORMANCE CAPABILITIES OF IODS AND AOS
 3*            INCLUDE COMBLK
 4*            READ(7,50) ISKIP
 5*         50 FORMAT(I1)
 6*            IF( ISKIP .EQ. 1) GO TO 120
 7*      C        READS IN NAMES OF PERSONNEL
 8*            READ(7,90) (NAME(M), M = 1,MENS)
 9*         90 FORMAT(6A6)
10*            DO 110 MM= 1, MENS
11*            READ(7,100) M, F(M), PREC(M), STRM(M), ASP(M)
12*        100 FORMAT(I1, 3X, 2F5.3, F5.0, F5.3)
13*            PASP(M) = ASP(M)
14*        110 CONTINUE
15*        120 CONTINUE
16*            IF(ORD(1) .NE. CHAR(1)) GO TO 200
17*            WRITE(2,150)
18*        150 FORMAT(1H , 30X, 19HOPERATOR PARAMETERS//
19*           1 12X, 3HMAN, 6X, 5HSPEED, 3X, 9HPRECISION,
20*           2 8H STRESS , 10HTHRESHOLD , 2X, 10HASPIRATION/)
21*            DO 170 M = 1, MENS
22*            WRITE(2,160)  NAME(M),  F(M), PREC(M), STRM(M), ASP(M)
23*        160 FORMAT(1H , 11X, A6, 2F10.2, F14.2, F15.3)
24*        170 CONTINUE
25*        200 CONTINUE
26*            RETURN
27*            END

***POIS***      ***POIS***
```

```
 1*            SUBROUTINE POIS(AM,RY,IPD)
 2*      C        SUPPLIES RANDOM NUMBERS FROM A POISSON DISTRIBUTION
 3*      C        IPD = INTEGER FROM A POISSON DISTRIBUTION
 4*      C        AM = A MEAN - ONLY NUMBER REQUIRED
 5*            IPD = 0
 6*            CALL RANDU(RY,1)
 7*         10 CONTINUE
 8*            IF( RY .LE. (EXP(-AM)))GO TO 50
 9*            R1 = RY
10*            IPD = IPD + 1
11*            CALL RANDU(RY,1)
12*            RY = RY * R1
13*            GO TO 10
14*         50 CONTINUE
15*            RETURN
16*            END
```

PROC ***PROC***

```
 1*            SUBROUTINE PROC
 2*            INCLUDE COMBLK
 3*            DIMENSION ERP(4)
 4*            DIMENSION AVPRB(20,4)
 5*            EQUIVALENCE ( AVPROB, AVPRB)
 6*      C        CALCULATE STRESS FACTOR FOR MESSAGE
 7*            SF = 0.
 8*            ZIF = 1.
 9*            TMIN = 0.
10*            IF( STR(M) .LE. 1. ) GO TO 3
11*            SF = (STR(M) - 1.)/(STRM(M) - 1.)
12*            ZIF = -1.829*SF**3 +3.472*SF**2  -2.351 * SF + 1.
13*            IF( SF .GE. 1) ZIF = .292
14*         3 CONTINUE
15*      C        DETERMINE APPROPRIATE TASK ANALYSIS FOR THIS MESSAGE TYPE
16*            IT = TYPE(MSG,J)
17*            K = TATA(J,IT)
18*            MCUM = CMSGNO(MSG,J)
19*      C        SET UP ERROR RATE MATRIX FOR THIS TYPE OPERATOR
20*            IF( J .EQ. 2 ) GO TO 5
21*            DO 4 IE = 1,4
```

```
*PROC***      ***PROC***

     22*            ERP(IE) = ERPG(IF)
     23*          4 CONTINUE
     24*            GO TO 7
     25*          5 CONTINUE
     26*            DO 6 IE = 1,4
     27*            ERP(IE) = ERPI(IF)
     28*          6 CONTINUE
     29*          7 CONTINUE
     30*            NERR = 0
     31*            TIME = 0.
     32*            IF( ORD(4) .NE. CHAR(1)) GO TO 30
     33*      C        PRINT OUT START OF MESSAGE PROCESSING PARAMETERS
     34*            WRITE(2,8) IDENT, IPAGE
     35*          8 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
     36*            IPAGE = IPAGE + 1
     37*            WRITE(2,9) MCUM, NAME(M), IDAY, NMTYP(IT), ZIF, IH,
     38*           1 MSG, PAFW, NSHF,   PAFA, IDL(IH,M), TARIV(MSG,J),Z(M)
     39*          9 FORMAT(1H , 9X, 14HMESSAGE NUMBER, I6,
     40*           2 24H            MAN            , A6, 13H          DAY, I12,
     41*           2 /26H          MESSAGE TYPE     , A6, 21H        STRESS FACTOR ,
     42*           3 F7.2, 16H              HOUR, I11,
     43*           4 /23H          MESSAGE ORDER, I7, 17H          FATIGUE, F13.2,
     44*           5 21H            ITERATION, I6,
     45*           6 /40X, 10HASPIRATION, F10.2,
     46*           7 /40X, 9HCUM. IDLE, F11.2,
     47*           8 /25H          MESSAGE ARRIVAL, F10.1,
     48*           9 /24H          MESSAGE START ,F11.1 //)
     49*            WRITE(2,20)
     50*         20 FORMAT(1H , 9X, 31HELEMENT   EXECUTION CUMULATIVE ,
     51*           1 56HOUTCOME   TYPE OF  CRITIC  SEGMENT   ERROR      ERROR   /
     52*           2 11X, 3HNO., 9X, 35HTIME      TIME     (SFR)    ELEMENT,
     53*           3 44H  -ALITY   ENDED     TYPE     RETURNS  INTRP//)
     54*         30 CONTINUE
     55*            IF( OUT(MSG,J) .EQ. CHAR(29)) GO TO 512
     56*            ST = Z(M)
     57*            I = 1
     58*      C        SET UP FOR INTERUPTED MESSAGE IF THERE IS ONE TO BE PROCESSED
     59*            IF (IFTE(MSG,J) .LE. 0 ) GO TO 40
     60*            ST = START(M)
     61*            I = IFTE(MSG,J)
     62*            MAN(MSG,J)  = 0
     63*            OUT(MSG,J) = CHAR(11)
     64*            NERR = INT(M)
     65*            INT(M) = 0
     66*            INTRPT(M) = 0
     67*            MSGTRP(M) = 0
     68*            IFTE(MSG,J) = 0
     69*            START(M) = 0.
     70*            GO TO 70
     71*         40 CONTINUE
     72*      C     DETERMINE IF MESSAGE IS REJECTED BY G-3
     73*            IF (J.NE.1.OR.JTYPE(I,K).NE.   1    .OR. PRIOR(MSG,J) .GT. 1)
     74*           1 GO TO 65
     75*            CALL RANDU(RY,1)
     76*            IF (RY .LE. AVPRB(I,K)) GO TO 65
     77*         60 OUT(MSG,J) =  CHAR(29)
     78*            GO TO 512
```

```
*PROC***      ***PROC***

     79*        65 CONTINUE
     80*           NERR = NER(MSG,J)
     81*        67 CONTINUE
     82*           IF( J .EQ. 1 .AND.I .EQ. 1 ) SEGS(MSGNUM,2) = Z(M)
     83*     C        STARTING POINT FOR TASK ELEMENT PROCESSING CYCLE
     84*        70 CONTINUE
     85*     C        CALCULATION OF INTERUPT DURATION AND OCCURRANCE
     86*           TMIN = 0.
     87*     C        THE FOLLOWING BYPASS ASSUMES DIMENSIONS OF 10 TASK ELEMENTS
     88*     C        AND 3 TASK ANALYSES
     89*           IF( I .GT. 10 .OR. K .GT. 3) GO TO 77
     90*           DO 76 II = 1,ITYMAX
     91*           IF( PROBI(I,K,II) .LE. 0.) GO TO 76
     92*           CALL RANDU(RY,1)
     93*           IF( RY .GT. PROBI(I,K,II)) GO TO 76
     94*           CALL RANDN(RY,RD,0., 1.)
     95*           TMIN = RD * ADI(I,K,II) + AITE(I,K,II)
     96*           GO TO 77
     97*        76 CONTINUE
     98*           II = 0
     99*        77 CONTINUE
    100*     C     DETERMINE IF ACTION UNIT IS A DECISION
    101*           IF (JTYPE(I,K).NE.   3   ) GO TO 90
    102*           CALL RANDU(RY,1)
    103*           IF (RY .GE. AVPRB(I,K)) GO TO 80
    104*           SIF = CHAR(30)
    105*           GO TO 250
    106*        80 CONTINUE
    107*           SIF = CHAR(17)
    108*           GO TO 250
    109*     C     DETERMINE IF AN EQUIPMENT ACTION UNIT IS INVOLVED
    110*        90 IF (JTYPE(I,K) .NE.    4   ) GO TO 110
    111*           CALL RANDN(RY,RD,0., 1.)
    112*           TIME = AVGTM(I,K) + RD*SIGMA(I,K)
    113*           IF(TIME .LT. (AVGTM(I,K)/ 3. ))TIME = AVGTM(I,K)/ 3.
    114*           CALL RANDU(RY,1)
    115*           IF (RY .GE. AVPRB(I,K)) GO TO 100
    116*           SIF = CHAR(30)
    117*           GO TO 350
    118*       100 SIF = CHAR(17)
    119*           GO TO 350
    120*       110 CONTINUE
    121*     C     DETERMINE NUMBER UNNOTED ERRORS THIS TASK ELEMENT
    122*     C     FOR TRANSFORM OPERATION
    123*       200 CONTINUE
    124*           IF (UETYPE(I,K)  .NE. CHAR(31)) GO TO 210
    125*           AL = LENTH(MSG,J)
    126*           IPD = 0
    127*           AM = ER(1,IT) * AL/100.
    128*           CALL POIS(AM,RY,IPD)
    129*           TIE1(MSG,M) = IPD
    130*           AM = ER(2,IT) * AL/100.
    131*           CALL POIS(AM,RY,IPD)
    132*           TIE2(MSG,M) = IPD
    133*           AM = ER(3,IT) * AL/100.
    134*           CALL POIS(AM,RY,IPD)
    135*           TIE3(MSG,M) = IPD
```

```
PROC***      ***PROC***

      AM = ER(4,IT) * AL/100.
      CALL POIS(AM,RY,IPD)
      TIE4(MSG,M) = IPD
      TNUE(MSG,J)=(TIE1(MSG,M)+TIE2(MSG,M)
     1+TIE3(MSG,M)  + TIE4(MSG,J))*PREC(M) + TNUE(MSG,J)
      IRESH(1,IH) = IRESH(1,IH) + TTE1(MSG,M)
      IRESH(2,IH) = IRESH(2,IH) + TTE2(MSG,M)
      IRESH(3,IH) = IRESH(3,IH) + TTE3(MSG,M)
      IRESH(4,IH) = IRESH(4,IH) + TTE4(MSG,M)
      IREST(1,IT) = IREST(1,IT) + TTE1(MSG,M)
      IREST(2,IT) = IREST(2,IT) + TTE2(MSG,M)
      IREST(3,IT) = IREST(3,IT) + TTE3(MSG,M)
      IREST(4,IT) = IREST(4,IT) + TTE4(MSG,M)
      IRESH(7,IH) = IRESH(7,IH) + 1
      IREST(7,IT) = IREST(7,IT) + 1
      GO TO 212
  210 CONTINUE
C        FOR OTHER THAN TRANSFORM OPERATIONS
      CALL RANDU(RY,1)
      IF (RY .GE. UEP(I,K)*PREC(M))GO TO 212
      TNUE(MSG,J) = 1 + TNUE(MSG,J)
  212 CONTINUE
C     DETERMINE CUMULATIVE NO. UNNOTED ERRORS TO GENERATE ERR RESPONSES
      IF( UETYPE(I,K) .NE. CHAR(31)) GO TO 215
C        FOR TRANSFORM ERRORS
      AM = TIE1(MSG,M) * ERP(1)
      CALL POIS(AM,RY,IPD)
      NER(MSG,J) = NER(MSG,J) + IPD
      AM = TIE2(MSG,M) * ERP(2)
      CALL POIS(AM,RY,IPD)
      NER(MSG,J) = NER(MSG,J) + IPD
      AM = TIE3(MSG,M) * ERP(3)
      CALL POIS(AM,RY,IPD)
      NER(MSG,J) = NER(MSG,J) + IPD
      AM = TIE4(MSG,M) * ERP(4)
      CALL POIS(AM,RY,IPD)
      NER(MSG,J) = NER(MSG,J)  + IPD
      IF( NER(MSG,J) .GT. 20) NER(MSG,J) = 20
      NERR = NER(MSG,J)
      GO TO 220
  215 CONTINUE
      CALL RANDU(RY,1)
      IF( RY .GE. ERP( 1)) GO TO 250
      IF( NER(MSG,J) .GT. 20) GO TO 250
      NER(MSG,J) = NER(MSG,J) + 1
      NERR = NERR + 1
  220 CONTINUE
C     CALCULATES TASK ELEMENT EXECUTION TIME
  250 CONTINUE
      CALL RANDN(RY,RD,0., 1.)
      V = AVGTM(I,K) + RD*(SIGMA(I,K))
      TIME = F(M) *V*7IF*PAFA*PAFW
      IF(TIME .LT. (AVGTM(I,K)/ 3.)) TIME = AVGTM(I,K)/3.
C     CHECK IF TIME IS A FUNCTION OF MESSAGE LENGTH
      IF (JTYPE(I,K) .EQ.    2   ) TIME = TIME* LENTH(MSG,J)
C        DETERMINES IF INTERUPTION DUE TO INCOMING MESSAGE HAS OCCURRED
      IF(J .NE. 2 .OR. FRHR(IH) .LE. 0.0) GO TO 259
```

```
*P.OC***      ***PROC***

193*                CALL RANDU(RY,1)
194*                IF(RY .GT. (FRHR(IH)/3600.) * TIME) GO TO 259
195*                CALL RANDU(RY,1)
196*                TIME = RY * TIME
197*                CALL RANDN(RY,RD,0.,1.)
198*                TMIN=RD*SDIN(IH) + DURIN(IH)
199*                II=10
200*                SIF= CHAR(20)
201*      C          SETTING I TO 1 ASSUMES TASK ELEMENT 2 SHOULD BE EXECUTED NEXT
202*                I = 1
203*                GO TO 350
204*          259   CONTINUE
205*      C       MODIFY ORIGINAL SUCCESS PROBABILITY AS FUNCTION OF PRECISION
206*                IF (PREC(M)-1.) 260,270,280
207*          260 PROB =(1. - AVPRB(I,K))* (1. - PREC(M))* 5.    + AVPRB(I,K)
208*                GO TO 290
209*          270 PROB = AVPRB(I,K)
210*                GO TO 290
211*          280 PROB = AVPRB(I,K) * (5. * (1. - PREC(M)) + 1. )
212*      C       DETERMINES IF TASK ELEMENT IS A SUCCESS OR NOTED FAILURE
213*          290  CALL  RANDU(RY,1)
214*               IF( STR(M) .LE. (STRM(M)/ 4.)) GO TO 294
215*               IF( ASP(M) + 1.  .LT. PROB) GO TO 294
216*               IF( STR(M) .LE. STRM(M)) GO TO 292
217*               IF( RY .LT. ASP(M)) GO TO 300
218*               GO TO 295
219*          292 CONTINUE
220*               ZA = PROB + (ASP(M)/3.)*(((4. * STR(M))/STRM(M)) - 1.)
221*               IF( RY .LT. ZA) GO TO 300
222*               GO TO 295
223*          294 IF (RY .LE. PROB) GO TO 300
224*          295 SIF = CHAR(17)
225*               GO TO 350
226*          300 SIF = CHAR(30)
227*      C       ADJUST TIME OF CURRENT WORK AND TOTAL WORK
228*          350 Z(M) = Z(M)+ TIME  + TMIN
229*               TW(IH,M) = TW(IH,M) + TIME + TMIN
230*      C       LAST TASK ELEMENT OF A TIME SEGMENT
231*               IF (END(I,K) .EQ. CHAR(11)) GO TO 400
232*               IEK = END(I,K)
233*               SEGS(MCUM,IEK) = Z(M)
234*      C       IS THIS A TYPE 6 TASK ELEMENT
235*          400 CONTINUE
236*               L = I
237*               IF (JTYPE(I,K) .NE.    6    ) GO TO 450
238*      C          PERFORM ERROR RETURN IF INDICATED
239*               IF (  NERR     ) 410,410,420
240*          410 I=IJS(I,K)
241*               GO TO 500
242*          420 I = IJF(I,K)
243*               NOFAIL(M)=NOFAIL(M)+3
244*               NERR = NERR - 1
245*               GO TO 500
246*      C       SET UP NEXT TASK ELEMENT
247*          450 IF(SIF .EQ. CHAR(17)) GO TO 460
248*               I = IJS(I,K)
249*               GO TO 470
```

```
      460 I = IJF(I,K)
C         COUNT FAILURE / SUCCESS FOR CRITICAL TASK ELEMENTS
      470 IF (CRIT(L,K) .NE. CHAR(14)) GO TO 500
          IF(SIF .EQ. CHAR(17)) GO TO 480
          NOSUC(M)=NOSUC(M)+1
          GO TO 500
      480 CONTINUE
          NOFAIL(M)=NOFAIL(M)+1
C         DOES THIS TASK ELEMENT RUN OVER THE HOUR
      500 CONTINUE
          IF (Z(M) .LT. ENDHR) GO TO 505
C         RETAIN CURRENT TASK ELEMENT DATA FOR NEXT HOUR MESSAGE
C            ALLOCATE TIME USED IN THIS HOUR AND IN NEXT HOUR
          DIF = TW(IH,M) + IDL(IH,M) - 3600.
          IF( DIF .GE. 0) GO TO 501
          IDL(IH,M) = IDL(IH,M) - DIF
          GO TO 503
      501 CONTINUE
          TW(IH + 1, M) = DIF
          TW(IH,M) = TW(IH,M) - DIF
      503 CONTINUE
          LDONE = LDONE + 1
          AVAIL(M) = 0
          IF( I .LE. 0 ) GO TO 505
          IFIF(MSG,J) = I
          MAN(MSG,J) = M
          OUT(MSG,J) = CHAR(20)
          START(M) = ST
      505 CONTINUE
C         PRINT OPTION 4 - RECORD TASK ELEMENT RESULTS
          IF( ORO(4)  .NE. CHAR(1)) GO TO 507
          WRITE(2    ,506)L,TIME,Z(M), SIF,JTYPE(L,K), CRIT(L,K), END(L,K),
         1 UETYPE(L,K), NERR,TMIN,II
      506 FORMAT(1H ,I13,F14.2,F11.2,5X,A1,9X,I1,7X,A1,7X,I1,9X,
         1 A1, I12,F6.2, I5)
      507 CONTINUE
          TMIN = 0
C            IF MESSAGE INCOMPLETE OR REJECTED
          IF( OUT(MSG,J) .EQ. CHAR(29))GO TO 512
          IF( OUT(MSG,J) .EQ. CHAR(20)) GO TO 515
C         LAST TASK ELEMENT
          IF( I .GT. 0) GO TO 70
          IF(J .EQ. 1) GO TO 508
C            CALCULATE INFORMATION LOSS
          T = TNUE(MSG,J)
C         B = INC(IT)
C         INFOLS(MCUM) = ((PUL + 10. * PUS) * T)/ B   + .4999
          INFOLS(MCUM) = ((PUL + 10. * PUS) * T)      + .4999
          INFLHR(IH) = INFLHR(IH) + INFOLS(MCUM)
          IRESH(6,IH) = IRESH(6,IH) + INFOLS(MCUM)
          IREST(6,IT) = IREST(6,IT) + INFOLS(MCUM)
          IRESH(5,IH) = IRESH(5,IH) + NER(MSG,J)
          IREST(5,IT) = IREST(5,IT) + NER(MSG,J)
          IRESH(7,IH) = IRESH(7,IH) + 1
          IREST(7,IT) = IREST(7,IT) + 1
      508 CONTINUE
C         SET TASK ELEMENT IF COMPLETED
```

```
*PROC***      ***PROC***

  307*              IF (OUT(MSG,J).EQ.CHAR(11)) OUT(MSG,J) = CHAR(14)
  308*             MSCPL(M) = MSCPL(M) + 1
  309*             MQCPL(IH,M) = MQCPL(IH,M) + 1
  310*      C         ACCUMULATE MEAN TIME PER MESSAGE FOR RUN SUMMARY
  311*             CMTMG(IH,M) = CMTMG(IH,M) + Z(M) - ST
  312*      C      PRINT OPTION 5-RECORD RESULTS OF MESSAGE SEGMENT
  313*             IF( ORO(5) .NE. CHAR(1) ) GO TO 520
  314*             IF(OUT(MSG,J) .NE. CHAR(14)) GO TO 600
  315*             IF( M .GT. MEN(1)) GO TO 510
  316*             WRITE(2,509) MCUM, NAME(M), TIE1(MSG,M),
  317*            1 TIE2(MSG,M), TIE3(MSG,M), TIE4(MSG,M),TNUE(MSG,J),
  318*            2 NER(MSG,J), INFOLS(MCUM)
  319*          509 FORMAT(1H ,/16H          MESSAGE, I4,
  320*            1 / 23H          PROCESSED BY  , A6,
  321*            2 /26H          TRANSFORM ERRORS,
  322*            3 / 21H            COMMISSION, I12,
  323*            4 / 26H            ABREV/TYPO/SPAC, I7,
  324*            4 / 19H            OMISSION  , I14,
  325*            5 / 22H           OTHER ERRORS, I11, /30X, 4H----,
  326*            6 / 29H           TOT. UNDET.  ERRORS, I4,
  327*            7 // 27H           NO. ERROR RETURNS, I6,
  328*            8 /  26H           INFORMATION LOSS , I7/)
  329*             GO TO 520
  330*          510 CONTINUE
  331*             WRITE(2,511) MCUM, NAME(M), TIE1(MSG,M),
  332*            1 TIE2(MSG,M), TIE3(MSG,M), TIE4(MSG,M),TNUE(MSG,J),
  333*            2 NER(MSG,J), INFOLS(MCUM)
  334*          511 FORMAT( 1H ,/16H          MESSAGE, I4,
  335*            1 / 23H          COMPLETED BY  , A6,
  336*            2 /26H          TRANSFORM ERRORS,
  337*            3 / 21H            COMMISSION, I12,
  338*            4 / 26H            ABREV/TYPO/SPAC, I7,
  339*            4 / 19H            OMISSION  , I14,
  340*            5 / 22H           OTHER ERRORS, I11, /30X, 4H----,
  341*            6 / 29H           TOT. UNDET.  ERRORS, I4,
  342*            7 // 27H           NO. ERROR RETURNS, I6,
  343*            8 /  26H           INFORMATION LOSS , I7/)
  344*             GO TO 520
  345*          512 CONTINUE
  346*             IF( ORO(4) .NE. CHAR(1) ) GO TO 514
  347*             WRITE(2,513) CMSGNO(MSG,J), NAME(M)
  348*          513 FORMAT(1H , 7HMESSAGE, I5,2X, 13H REJECTED BY  , A6)
  349*          514 CONTINUE
  350*             MQREJ(IH,M) = MQREJ(IH,M) + 1
  351*             MSREJ(M) = MSREJ(M) + 1
  352*             MESS(2,J) = MESS(2,J) - 1
  353*             GO TO 600
  354*          515 CONTINUE
  355*             IF( ORO(4) .NE. CHAR(1)) GO TO 517
  356*             WRITE(2,516) CMSGNO(MSG,J), M
  357*          516 FORMAT(1H ,  7HMESSAGE, I5,2X, 19HINTERUPTED WITH MAN, I3)
  358*          517 CONTINUE
  359*             INTRPT(M) = 1
  360*             MSGIRP(M) = MCUM
  361*             INT(M) = NERR
  362*             MQINT(IH,J) = MQINT(IH,J) + 1
  363*             MESS(2,J) = MESS(2,J) - 1
```

```
PROC***      ***PROC***

  364*              GO TO 600
  365*        520 CONTINUE
  366*              IF( J .EQ. 1) GO TO 530
  367*              MESS(2,2) = MESS(2,2) - 1
  368*              SEGS(MCUM,7) = Z(M)
  369*              ATPM = ATPM + SEGS(MCUM,6) - SEGS(MCUM,1)
  370*              AQT=AQT+SEGS(MCUM,2)-SEGS(MCUM,1)
  371*              AHT=AHT+SEGS(MCUM,6)-SEGS(MCUM,2)
  372*              GO TO 600
  373*        530 CONTINUE
  374*              MESS(2,1) = MESS(2,1) - 1
  375*              MT = MESS(1,2) + 1
  376*        C        COMPLETED MESSAGES FROM AQ-G3 GO INTO IOD QUEUE
  377*              TARIV(MT,2) = Z(M)
  378*              CMSGNO(MT,2) = CMSGNO(MSG,1)
  379*              PRIOR(MT,2) = PRIOR(MSG,1)
  380*              LENTH(MT,2) = LENTH(MSG,1)
  381*              TYPE(MT,2) = TYPE(MSG,1)
  382*              TNUE(MT,2) = TNUE(MSG,1)
  383*              NER(MT,2) = NER(MSG,1)
  384*              MAN(MT,2) = 0
  385*              IETE(MT,2) = 0
  386*              OUT(MT,2) = CHAR(11)
  387*              MESS(2,2) = MESS(2,2) + 1
  388*              MESS(1,2) = MT
  389*        C        SORT TO PUT MESSAGES IN ORDER OF ARRIVAL TIME
  390*              DO 550 MGS = 1, MT
  391*              MGS1 = MGS + 1
  392*              IF( MGS1 .GT. MT) GO TO 550
  393*              DO 540 MG = MGS1, MT
  394*              IF( TARIV(MGS,2) .LE. TARIV(MG,2)) GO TO 540
  395*              PRIORT = PRIOR(MGS,2)
  396*              LENTHT = LENTH(MGS,2)
  397*              TYPET = TYPE(MGS,2)
  398*              TARIVT = TARIV(MGS,2)
  399*              MSGT  = CMSGNO(MGS,2)
  400*              NUET = TNUE(MGS,2)
  401*              NERT = NER(MGS,2)
  402*              OUTT = OUT(MGS,2)
  403*              IETET = IETE(MGS,2)
  404*              MANT = MAN(MGS,2)
  405*              PRIOR(MGS,2) = PRIOR(MG,2)
  406*              LENTH(MGS,2) = LENTH(MG,2)
  407*              TYPE(MGS,2) = TYPE(MG,2)
  408*              TARIV(MGS,2) = TARIV(MG,2)
  409*              CMSGNO(MGS,2) = CMSGNO(MG,2)
  410*              TNUE(MGS,2) = TNUE(MG,2)
  411*              NER(MGS,2) = NER(MG,2)
  412*              OUT(MGS,2) = OUT(MG,2)
  413*              IETE(MGS,2) = IETE(MG,2)
  414*              MAN(MGS,2) = MAN(MG,2)
  415*              PRIOR(MG,2) = PRIORT
  416*              LENTH(MG,2) = LENTHT
  417*              TYPE(MG,2) = TYPET
  418*              TARIV(MG,2) = TARIVT
  419*              CMSGNO(MG,2) =  MSGT
  420*              TNUE(MG,2) = NUET
```

```
*P.OC***  -     ***PROC***

  421*              NER(MG,2) = NERT
  422*              OUT(MG,2) = OUTT
  423*              IFTE(MG,2) = IFTET
  424*              MAN(MG,2) = MANT
  425*          540 CONTINUE
  426*          550 CONTINUE
  427*          600 CONTINUE
  428*              IF( ORO(5) .NE. CHAR(1)) GO TO 700
  429*              IF(J.EQ.2 .AND. OUT(MSG,J).EQ.CHAR(14)) WRITE(2,650)MCUM,
  430*             1(SEGS(MCUM,IS), IS = 1,7)
  431*          650 FORMAT(1H , 22H                MESSAGE NO.,  I5/ 2X,
  432*             1 7HSEGMENT, 2X, 1H1, 9X, 1H2, 9X, 1H3, 9X, 1H4, 9X, 1H5, 9X,1H6,
  433*             2 9X, 1H7, //4X, 7F10.1)
  434*          700 CONTINUE
  435*              RETURN
  436*              END

    ***RANDN***     ***RANDN***


    1*              SUBROUTINE RANDN(RY,RD,AM,S)
    2*              A = 0.0
    3*              DO 10 I= 1,12
    4*              CALL RANDU(RY,1)
    5*           10 A= A + RY
    6*              RD=(A-6.0) * S + AM
    7*              RETURN
    8*              END

    ***RANDU***     ***RANDU***


    1*              SUBROUTINE RANDU(RY,N)
    2*              IRY = IFIX( RY / .74505806E-08)
    3*              IRY = AND(IRY * 65539, 134217727)
    4*              RY = FLOAT(IRY * .74505806E-08)
    5*              RETURN
    6*              END

    ***RESET***     ***RESET***
```

```
      SUBROUTINE RESET
C     RESETS CONDITIONS REQUIRED TO START A NEW SHIFT
C     I.E. A NEW SIMULATION ITERATION OR RUN
      INCLUDE COMBLK
      SHFTOV = CHAR(11)
      MESS(1,1) = 0
      MESS(1,2) = 0
      MESS(2,1) = 0
      MESS(2,2) = 0
      PAFA = 1.
      PAFW = 1.
      AQT=0.0
      AHT=0.0
      ATPM = 0.
      KINKS = 0
      DO 20 IH = 1,THMAX
      INFLHR(IH) = 0
      DO 10 IC = 1,5
      EC(IH,IC) = 0.
   10 CONTINUE
      DO 15 KQ = 1,MENS
      MQREJ(IH,KQ) = 0
      MQCPL(IH,KQ) = 0
      TW(IH,KQ) = 0.
      IDL(IH,KQ) = 0.
   15 CONTINUE
      DO 17  J = 1,2
      MQINT(IH,J) = 0
   17 CONTINUE
   20 CONTINUE
      IH = 1
C     ZIH = 0.
      ZIH=TZERO
      ENDHR = ZIH + 3600.
      SHFTOV = CHAR(11)
      DO 50 CMSG= 1,200
      ITYC(CMSG) = 0
      INFOLS(CMSG) = 0
      DO 40 ITT = 1,7
C     SEGS(CMSG,ITT) = 0.
      SEGS(CMSG,ITT) = ZIH
   40 CONTINUE
   50 CONTINUE
      DO 100 M = 1,MENS
```

```
*RESET***      ***RESET***

     45*                ASP(M) = PASP(M)
     46*                AVAIL(M) = CHAR(1)
     47*           C    Z(M) = 0.
     48*                Z(M) = ZIH
     49*                PERF(M) = ASP(M)
     50*                NOSUC(M) = 0
     51*                NOFAIL(M) = 0
     52*                INTRPT(M) = 0
     53*                MSGTRP(M) = 0
     54*                MSCPL(M) = 0
     55*                MSREJ(M) = 0
     56*                INT(M) = 0
     57*                DO 90 MGG = 1, 50
     58*                TIE1(MGG,M) = 0.
     59*                TIE2(MGG,M) = 0.
     60*                TIE3(MGG,M) = 0.
     61*                TIE4(MGG,M) = 0.
     62*              90 CONTINUE
     63*             100 CONTINUE
     64*                CMSG = 0
     65*                DO 300 J = 1,2
     66*                DO 200 I = 1,50
     67*                CMSGNO(I,J) = 0
     68*                PRIOR(I,J) = 0
     69*                LENTH(I,J) = 0
     70*                TYPE(I,J) = 0
     71*           C    TARIV(I,J) = 0.
     72*                TARIV(I,J) = ZIH
     73*                TNUE(I,J) = 0
     74*                NER(I,J) = 0
     75*                MAN(I,J) = 0
     76*                IFTE(I,J) = 0
     77*                OUT(I,J) = CHAR(11)
     78*            200 CONTINUE
     79*            300 CONTINUE
     80*                DO 400 IT = 1,8
     81*                NTMT(IT) = 0
     82*                NCT(IT) = 0
     83*                DO 350 KP = 1,5
     84*                TMT(IT,KP) = 0.
     85*                CT(IT,KP) = 0.
     86*            350 CONTINUE
     87*            400 CONTINUE
     88*                DO 450 IP = 1,5
     89*                NCP(IP) = 0
     90*                DO 450 KP = 1,5
     91*                CP(IP,KP) = 0.
     92*            450 CONTINUE
     93*                RETURN
     94*                END

     ***RESHR***      ***RESHR***
```

```
      SUBROUTINE RESHR
C     RESETS CONDITIONS FOR START OF SIMULATION OF NEXT HOUR
C        ALSO COMPUTES HOUR SUMMARY
      INCLUDE COMBLK
      INFOLC = INFLHR(IH)
C        CALCULATE THOROUGHNESS-EC(1)- FOR THIS HOUR
      A = 0
      DO 5 M = 1, MENS
      A = A + MQCPL(IH,M)
    5 CONTINUE
      B = MESS(1,2)
      C = MESS(1,1)
      IF(( B + C) .GT. 0.) GO TO 8
      DO 6 I = 1,5
      EC(IH,I) = 1.
    6 CONTINUE
      EFF = 1.
      GO TO 45
    8 CONTINUE
      EC(IH,1)= A/(B+C)
      IF( EC(IH,1) .LT. 0.) EC(IH,1) = 0.
C        CALCULATE COMPLETENESS -EC(2)- FOR THIS HOUR
      DO 10 M = 1,MENS
      EC(IH,2) = EC(IH,2) + PERF(M)
   10 CONTINUE
      EC(IH,2) = EC(IH,2) / MENS
      IF( EC(IH,2) .LT. 0.) EC(IH,2) = 0.
C        CALCULATE RESPONSIVENESS-EC(3)- FOR THIS HOUR
      A = 0
      MS = MEN(1) + 1
      DO 30 M = MS, MENS
      A = A + MQCPL(IH,M)
   30 CONTINUE
      ATPM = ATPM/A
```

```
*RFSHR***      ***RESHR***

     35*      C      EC(IH,3)= 1. - ATPM/ 700.
     36*      C      IF( EC(IH,3) .LT. 0.) EC(IH,3) = 0.
     37*      C       NEW RESPONSIVENESS  04/28/73
     38*             AQT=AQT/A
     39*             AHT=AHT/A
     40*             X=1.0
     41*             IF(AHT.GT.300.) X=1.3-.001*AHT
     42*             IF(X.GT.1.0) X=1.0
     43*             IF(X.LT.0.0) X=0.0
     44*             EC(IH,3)=X
     45*             X=1.0
     46*             IF(AQT.GT.300.) X=(96.-0.02*AQT)/90.
     47*             IF(X.GT.1.0) X=1.0
     48*             IF(X.LT.0.0) X=0.0
     49*             EC(IH,3)=EC(IH,3)*X
     50*      C        CALCULATE ACCURACY -EC(4)- FOR THIS HOUR
     51*             X = FLOAT(INFOLC) / 10.
     52*             EC(IH,4) = 1. - X/A
     53*             IF( EC(IH,4) .LT. 0.) EC(IH,4) = 0.
     54*      C          CALCULATE EFFECTIVENESS
     55*             TEM=CC12**2 + CC13**2 + CC14**2 + CC23**2 + CC24**2 + CC34**2
     56*             EFF=TEM/6.0
     57*             EFF = EFF * ( W(1) * EC(IH,1)+ W(2)*EC(IH,2) + W(3)*EC(IH,3)
     58*            1 + W(4) * EC(IH,4))
     59*             EFF=EFF +((6.0-TEM)/6.0) * ( EC(IH,1)**W(1) * EC(IH,2)**W(2) *
     60*            1  EC(IH,3)**W(3) * EC(IH,4)**W(4))
     61*             EC(IH,5) = EFF
     62*             IF( EC(IH,5) .LT. 0.) EC(IH,5) = 0.
     63*      C          ACCUMULATE RUN EFFECTIVENESS DATA
     64*          45 CONTINUE
     65*             DO 50 I = 1,5
     66*             CEC(IH,I) = CEC(IH,I) + EC(IH,I)
     67*          50 CONTINUE
     68*      C          ACCUMULATE MANPOWER UTILIZATION RUN DATA
     69*             DO 60  M = 1,MENS
     70*             CTWH(IH,M) = CTWH(IH,M) + TW(IH,M)
     71*             CIDH(IH,M) = CIDH(IH,M) + IDL(IH,M)
     72*             MGCP(IH,M) = MGCP(IH,M) + MSCPL(M)
     73*             IF( STR(M) .LT. 0.) STR(M) = 0.
     74*             CFS(IH,M) = CFS(IH,M) +  STR(M)
     75*             CFA(IH,M) = CFA(IH,M) + ASP(M)
     76*          60 CONTINUE
     77*             IF( ORO(6) .NE. CHAR(1) ) GO TO 530
     78*             WRITE(2,490) IDENT, IPAGE
     79*         490 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
     80*             IPAGE = IPAGE + 1
     81*             WRITE(2,512) IH, IDAY, NSHF
     82*         512 FORMAT(1H , 19HEND OF HOUR RESULTS, 11X, 4HHOUR, I10/
     83*            1 31X, 3HDAY, I11/
     84*            2  31X, 9HITERATION, I5//)
     85*             WRITE(2,513)(( M,MSCPL(M), MSREJ(M), INTRPT(M), TW(IH,M),
     86*            1 IDL(IH,M),      STR(M), ASP(M), PERF(M) ),M=1,MENS )
     87*         513 FORMAT(1H , 25HOPERATOR PERFORMANCE DATA/
     88*            1 28X, 12H--MESSAGES--,14X, 8H--TIME--, 12X,
     89*            2 17H------FINAL------/
     90*            3 13X, 38HMAN      COMPLETED REJECTED INTERRUPTED,
     91*            4 48H  WORKED     OTHER      STRESS  ASPIRATION PERFORM/
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```
*ReSHR***      ***RESHR***

     92*           5(14X, I2, I11, I10, I10, F12.1, F10.1, F9.2, F9.2, F10.2/) )
     93*            WRITE(2   ,514)ATPM,MESS(1,1), INFOLC, (EC(IH,IV),IV=1,4), EFF
     94*       514 FORMAT(1H , 19X, 24HMESSAGE PERFORMANCE DATA/
     95*          1 23X, 24HAVERAGE TIME PER MESSAGE, F25.1/
     96*          2 23X, 37HMESSAGES IN AO-G3 QUEUE AT HOUR START, I10/
     97*          3 23X, 22HTOTAL INFORMATION LOSS, I25/
     98*          4 23X, 24HEFFECTIVENESS COMPONENTS/
     99*          5 26X, 12HTHOROUGHNESS, F14.2/
    100*          5 26X, 12HCOMPLETENESS, F14.2/
    101*          6 26X, 14HRESPONSIVENESS, F12.2/
    102*          7 26X, 8HACCURACY, F18.2/
    103*          8 47X, 6H------,/25X, 14HEFFECTIVENESS=,F13.2/)
    104*            WRITE(2,520)
    105*       520 FORMAT(1H , 18X, 23HDETAILED MESSAGE TIMING/
    106*          1 20X, 17HCUMULATIVE   TYPE/22X, 7HMESSAGE/
    107*          2 22X, 6HNUMBER, 16X,
    108*          3 42HT1        T2        T3        T4        T5)
    109*       530 CONTINUE
    110*           DO 550 MSG = 1, CMSG
    111*           IF(SEGS(MSG,7) .LE. 0) GO TO  550
    112*           IT = ITYC(MSG)
    113*           T1 = SEGS(MSG,2) - SEGS(MSG,1)
    114*           T2 = SEGS(MSG,3) - SEGS(MSG,2)
    115*           T3 = SEGS(MSG,4) - SEGS(MSG,3)
    116*           T4 = SEGS(MSG,5) - SEGS(MSG,4)
    117*           T5 = SEGS(MSG,6) - SEGS(MSG,5)
    118*           IF( ORO(6) .NE. CHAR(1)) GO TO 541
    119*           WRITE(2,540) MSG,IT,T1,T2,T3, T4, T5
    120*       540 FORMAT(1H , 21X, I3, I11, 5F10.1)
    121*       541 CONTINUE
    122*     C       ACCUMULATE TIME SEGMENT TIMES BY TYPE
    123*           TMT(IT,1) = TMT(IT,1) + T1
    124*           TMT(IT,2) = TMT(IT,2) + T2
    125*           TMT(IT,3) = TMT(IT,3) + T3
    126*           TMT(IT,4) = TMT(IT,4) + T4
    127*           TMT(IT,5) = TMT(IT,5) + T5
    128*           NTMT(IT) = NTMT(IT) + 1
    129*           CT(IT,1)= CT(IT,1) + T1
    130*           CT(IT,2)= CT(IT,2) + T2
    131*           CT(IT,3)= CT(IT,3) + T3
    132*           CT(IT,4)= CT(IT,4) + T4
    133*           CT(IT,5)= CT(IT,5) + T5
    134*           NCT(IT) = NCT(IT) + 1
    135*     C       ACCUMULATE TIME SEGMENT TIMES BY HOUR
    136*           CTSH(IH,1) = CTSH(IH,1) + T1
    137*           CTSH(IH,2) = CTSH(IH,2) + T2
    138*           CTSH(IH,3) = CTSH(IH,3) + T3
    139*           CTSH(IH,4) = CTSH(IH,4) + T4
    140*           CTSH(IH,5) = CTSH(IH,5) + T5
    141*           NCTSH(IH) = NCTSH(IH) + 1
    142*     C       ACCUMULATE TIME SEGMENT TIMES BY PRIORITY
    143*           IP = IPRI(MSG)
    144*           CP(IP,1) = CP(IP,1) + T1
    145*           CP(IP,2) = CP(IP,2) + T2
    146*           CP(IP,3) = CP(IP,3) + T3
    147*           CP(IP,4) = CP(IP,4) + T4
    148*           CP(IP,5) = CP(IP,5) + T5
```

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*ReSHR***      ***RFSHR***

  149*              NCP(IP) = NCP(IP) + 1
  150*              SEGS(MSG,7) = 0.
  151*          550 CONTINUE
  152*              DO 570 IT = 1,7
  153*               X = NTMT(IT)
  154*              DO 560 L = 1,5
  155*              IF( NTMT(IT) .EQ. 0 ) GO TO 560
  156*              TMT(IT,L) = TMT(IT,L) / X
  157*          560 CONTINUE
  158*          570 CONTINUE
  159*              IF( ORO(6) .NE. CHAR(1) ) GO TO 600
  160*              WRITE(2,580)(  IT, NTMT(IT), (TMT(IT,L), L= 1,5),IT= 1,7)
  161*          580 FORMAT(1H ,/20X,17HMESSAGE    NUMBER/
  162*             1 23X, 17HTYPE    COMPLETED,
  163*             2 464    T1         T2         T3         T4         T5/
  164*             3(24X, I1, I11,     5F10.1))
  165*          590 CONTINUE
  166*          600 CONTINUE
  167*      C       GET READY FOR NEXT HOUR
  168*              HROVER = CHAR(11)
  169*              DO 700 M = 1,MENS
  170*              AVAIL(M)= CHAR(1)
  171*              MSGPL(M) = 0
  172*              MSREJ(M) = 0
  173*              DO 650 MGG = 1,50
  174*              TIE1(MGG,M) = 0.
  175*              TIE2(MGG,M) = 0.
  176*              TIE3(MGG,M) = 0.
  177*              TIE4(MGG,M) = 0.
  178*          650 CONTINUE
  179*          700 CONTINUE
  180*              KINKS = MQINT(IH,1)  + MQINT(IH,2)
  181*              IH = IH + 1
  182*              IF(IH .GE. (IHMAX + 1 )) SHFTOV = CHAR(36)
  183*              ZIH = ZIH + 3600.
  184*              ENDHR = ZIH + 3600.
  185*          800 CONTINUE
  186*              LDONE = 0
  187*              ATPM = 0
  188*              AQT=0.0
  189*              AHT=0.0
  190*              DO 850 IT = 1,8
  191*              NTMT(IT) = 0
  192*              DO 840 L = 1,5
  193*              TMT(IT,L) = 0.
  194*          840 CONTINUE
  195*          850 CONTINUE
  196*              RETURN
  197*              END

      ***RUNSUM***      ***RUNSUM***
```

```
      SUBROUTINE RUNSUM
C        PRINTS RUN SUMMERY AVERAGES ACCROSS ITERATIONS
      INCLUDE COMBLK
      WRITE(2,5) IDENT, IPAGE
    5 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
      IPAGE = IPAGE + 1
      M=ICHAIN
      IF(M.LE.0) M=1
      WRITE(2,10) M
   10  FORMAT(1H /10X, 5HSHIFT,I2, 8H SUMMARY//)
C        PRINT OUT MANPOWER UTILIZATION DATA
      WRITE(2,20)
   20 FORMAT(1H , //9X, 20HMANPOWER UTILIZATION,
     1  // 15X, 31HTIME WORKED       TIME OTHER   ,
     2 21HMSG UNITS   MEAN TIME,
     3 20H       FINAL    FINAL,
     5  /46X, 23HPROCESSED  PER MESSAGE,
     6 21H   STRESS  ASPIRATION  ,
     7 /4X, 27HHOUR       MAN          PROD )
```

```
*RUNSUM***      ***RUNSUM***

      X = NSHIFT
      DO 25 M = 1, MENS
      TPMC(M) = 0.
      MCL(M) = 0
      SRS(M) = 0.
      ASS(M) = 0.
      WOR(M) = 0.
      TMI(M) = 0.
   25 CONTINUE
      DO 50 IH = 1, IHMAX
      WRITE(2,26) IH
   26 FORMAT(1H , I5)
      DO 40 M = 1, MENS
      WORK = CTWH(IH,M)/X
      WOR(M) = WOR(M) + WORK
      TMIDL = CIDH(IH,M)/X
      TMI(M) = TMI(M) + TMIDL
      PROP = WORK/ 3600.
      YY= MGCP(IH,M)
      TPM = CMTMG(IH,M)/YY
      IF( YY .LE. 0 ) TPM = 0.
      TPMC(M) = TPMC(M) + CMTMG(IH,M)
      MCL(M) = MCL(M) + MGCP(IH,M)
      SR = CFS(IH,M)/X
      SRS(M) = SRS(M) + SR
      AS = CFA(IH,M) / X
      ASS(M) = ASS(M) + AS
      EXTPMH(IH,M) = TPM
      EXASPH(IH,M)= AS
      MGC = FLOAT( MGCP(IH,M)) / X
      WRITE(2,30)    M,WORK,PROP,TMIDL,MGC,
     1 TPM, SR, AS
   30 FORMAT(1H , 5X,      I10, F8.0, F7.2, F10.0, I12, F14.0,F12.3,
     1 F9.3)
   40 CONTINUE
   50 CONTINUE
      WRITE(2,70)
   70 FORMAT(1H ,/36H MEANS FOR EACH MAN PER MESSAGE UNIT )
      Q = IHMAX
       A =00
       B = 0
       C = 0
       D = 0
       E = 0.
       H = 0
      G = MENS
      DO 100 M = 1, MENS
      WORK = WOR(M) / Q
      TMIDL = TMI(M) / Q
      PROP = WORK/ 3600.
      YY= MCL(M)
      TPM = 0
      IF( MCL(M) .LE. 0 ) GO TO 75
      TPM = TPMC(M) / YY
   75 CONTINUE
      SR = SRS(M) / Q
      AS = ASS(M) / Q
```

```
*RUNSUM***      ***RUNSUM***

     77*            IF(WORK.EQ.0.0) GO TO 78
     78*              A = A + WORK
     79*              B = B + TMIDL
     80*              C = C + YY
     81*              D = D + TPM
     82*              E = E + SR
     83*              H = H + AS
     84*              GO TO 79
     85*           78 G=G-1
     86*            79 CONTINUE
     87*              EXTPM(M) = TPM
     88*              EXASP(M) = AS
     89*              WRITE(2, 80) M, WORK, PROP, TMIDL, MCL(M), TPM, SR, AS
     90*           80 FORMAT(1H , I15, F8.0, F7.2, F10.0, I12, F14.0, F12.3, F9.3)
     91*          100 CONTINUE
     92*              WRITE(2, 120)
     93*          120 FORMAT( 1H , / 7H TOTALS)
     94*              KC = C
     95*              PROP = WORK / ( MENS * 3600.)
     96*              WRITE(2,140) A, PROP, B,KC, D, E, H
     97*              WRITE(2,130)
     98*          130 FORMAT(1H , // 12H GRAND MEANS/)
     99*              WORK = A / G
    100*              TMIDL = B / G
    101*              MSG = C / G
    102*              TPM = D / G
    103*              SR = E / G
    104*              AS = H / G
    105*              PROP = WORK / 3600.
    106*              WRITE(2,140) WORK, PROP, TMIDL, MSG, TPM, SR, AS
    107*          140 FORMAT(1H , F23.0, F7.2, F10.0, I12, F14.0, F12.3, F9.3)
    108*        C        PRINT OUT TIME SEGMENT DATA BY HOUR
    109*              WRITE(2,5) IDENT, IPAGE
    110*              IF(ICHAIN.EQ.0) GO TO 145
    111*              GMEANS(1)=GMEANS(1)+WORK
    112*              GMEANS(2)=GMEANS(2)+PROP
    113*              GMEANS(3)=GMEANS(3)+TMIDL
    114*              GMEANS(4)=GMEANS(4)+MSG
    115*              GMEANS(5)=GMEANS(5)+TPM
    116*              GMEANS(6)=GMEANS(6)+SR
    117*              GMEANS(7)=GMEANS(7)+AS
    118*              IBLK1=IBLK1+1
    119*               ENCODE(48,9145,LINE) ICHAIN,WORK,PROP,TMIDL,MSG,TPM,SR,AS
    120*           9145  FORMAT(I7,F16.0,F7.2,F10.0,I12,F14.0,F12.3,F9.3)
    121*        C      WRITE(3'IBLK1) LINE
    122*          145  CONTINUE
    123*              IPAGE = IPAGE + 1
    124*              NCC = 0
    125*              WRITE(2,200)
    126*          200 FORMAT(1H , 28X, 13HTIME SEGMENTS,
    127*             1 /7X, 34H----T1----  ----T2----  ----T3----,
    128*             2 41H  ----T4----  ----T5----      TOTAL  TOTAL,
    129*             3 /41H  HOUR TIME  PROP  TIME  PROP  TIME  PROP,
    130*             4 43H  TIME  PROP  TIME  PROP      (SUM) MESSAGES   )
    131*              DO 250 IH = 1, IHMAX
    132*              IF( NCTSH(IH) .LE. 0) GO TO 250
    133*              SUM = 0.
```

```
*RUNSUM***      ***RUNSUM***

  134*              X = NCTSH(IH)
  135*              NCC = NCC + NCTSH(IH)
  136*              DO 210 IS = 1,5
  137*              CH(IS) = CH(IS) + CTSH(IH,IS)
  138*              CTSH(IH,IS) = CTSH(IH,IS) / X
  139*              SUM = SUM + CTSH(IH,IS)
  140*          210 CONTINUE
  141*              DO 220 IS = 1,5
  142*              PRP(IS) = CTSH(IH,IS) / SUM
  143*          220 CONTINUE
  144*              WRITE(2,230) IH, (CTSH(IH,IS), PRP(IS),IS=1,5),SUM, NCTSH(IH)
  145*          230 FORMAT(1H , I4, 5(F6.0, F6.2), F10.0, I6)
  146*          250 CONTINUE
  147*              SUM = 0.
  148*              DO 260 IS = 1,5
  149*              CH(IS) = CH(IS) / NCC
  150*              SUM = SUM + CH(IS)
  151*          260 CONTINUE
  152*              DO 270 IS = 1,5
  153*              PRP(IS) = CH(IS) / SUM
  154*          270 CONTINUE
  155*              EXPR(1) = SUM
  156*              WRITE(2,280) (CH(IS), PRP(IS), IS = 1,5), SUM, NCC
  157*          280 FORMAT(1H ,/5H MEAN,5(F6.0,F6.2), F10.0, I6)
  158*              IF(ICHAIN.EQ.0) GO TO 285
  159*              K=-1
  160*              DO 282 I=1,5
  161*              K=K+2
  162*              GTSMNS(K)=GTSMNS(K)+CH(I)
  163*          282  GTSMNS(K+1)=GTSMNS(K+1)+PRP(I)
  164*              GTSMNS(11)=GTSMNS(11)+SUM
  165*              GTSMNS(12)=GTSMNS(12)+NCC
  166*              ENCODE(48,9282,LINE) ICHAIN,(CH(IS),PRP(IS),IS=1,5),SUM,NCC
  167*         9282  FORMAT(I4,1X,5(F6.0,F6.2),F10.0,I6)
  168*              IBLK1=IBLK1+1
  169*      C       WRITE(3'IBLK1) LINE
  170*          285  CONTINUE
  171*      C          PRINT OUT TIME SEGMENT DATA BY MESSAGE TYPE
  172*              WRITE(2,290) (IS, IS= 1,5)
  173*          290 FORMAT(1H // 6H TYPE ,
  174*             1  5(6H ----T,I1, 5H---- ),
  175*             2 14H     TOTAL     N,
  176*             3 /5H  MSG, 5(12H  TIME  PROP),
  177*             4 16H       (SUM)   CPL)
  178*      C       DO 370 IT = 1,8
  179*              DO 378 IT=1,7
  180*              IF(NCTST(IT) .LE. 0) GO TO 370
  181*              X = NCTST(IT)
  182*              SUM = 0.
  183*              DO 340 IS = 1,5
  184*              CTST(IT,IS) = CTST(IT,IS) / X
  185*              SUM = SUM + CTST(IT,IS)
  186*          340 CONTINUE
  187*              DO 350 IS = 1,5
  188*              PRP(IS) = CTST(IT,IS) / SUM
  189*          350 CONTINUE
  190*              WRITE(2, 360) IT, (CTST(IT,IS), PRP(IS),IS=1,5),
```

```
*R.,NSUM***      ***RUNSUM***

  191*          1 SUM, NCTST(IT)
  192*       360 FORMAT(1H , I3, 1X, 5(F6.0,F6.2), F10.0, I6)
  193*     C 370 CONTINUE
  194*       370  IF(ICHAIN.EQ.0) GO TO 378
  195*            K=-1
  196*            DO 372 I=1,5
  197*            K=K+2
  198*            TSMNST(IT,K)=TSMNST(IT,K)+CTST(IT,I)
  199*       372 TSMNST(IT,K+1)=TSMNST(IT,K+1)+PRP(I)
  200*            TSMNST(IT,11)=TSMNST(IT,11)+SUM
  201*            TSMNST(IT,12)=TSMNST(IT,12)+NCTST(IT)
  202*            ENCODE(84,9378,LINE) ICHAIN,IT,(CTST(IT,IS),PRP(IS),IS=1,5),SUM,
  203*           1  NCTST(IT)
  204*      9378 FORMAT(I6,I4,1X,5(F6.0,F6.2),F10.0,I6)
  205*            IBLK1=IBLK1+1
  206*     C      WRITE(3'IBLK1) LINE
  207*       378  CONTINUE
  208*     C         PRINT OUT TIME SEGMENT DATA BY MESSAGE PRIORITY
  209*            WRITE(2,380) (IS, IS = 1,5)
  210*       380 FORMAT(1H , // 6H PRIOR,
  211*           1  5(6H ----T,I1, 5H---- ),
  212*           2 14H     TOTAL     N,
  213*           3 /5H  MSG, 5(12H  TIME  PROP),
  214*           4 16H      (SUM)    CPL)
  215*            DO 455 IP=1,5
  216*     C      DO 450 IP = 1,5
  217*            IF( NCTSP(IP) .LE. 0) GO TO 450
  218*            X = NCTSP(IP)
  219*            SUM = 0.
  220*            DO 400 IS = 1,5
  221*            CTSP(IP,IS) = CTSP(IP,IS) / X
  222*            SUM = SUM + CTSP(IP,IS)
  223*       400 CONTINUE
  224*            DO 410 IS = 1,5
  225*            PRP(IS) = CTSP(IP,IS) / SUM
  226*       410 CONTINUE
  227*            WRITE(2,420) IP, (CTSP(IP,IS),PRP(IS),IS=1,5),SUM,NCTSP(IP)
  228*       420 FORMAT(1H , I3, 1X, 5(F6.0,F6.2), F10.0, I6)
  229*     C 450 CONTINUE
  230*       450  IF(ICHAIN.EQ.0) GO TO 455
  231*            K=-1
  232*            DO 452 I=1,5
  233*            K=K+2
  234*            TSMNSP(IP,K)=TSMNSP(IP,K)+CTSP(IP,I)
  235*       452  TSMNSP(IP,K+1)=TSMNSP(IP,K+1)+PRP(I)
  236*            TSMNSP(IP,11)=TSMNSP(IP,11)+SUM
  237*            TSMNSP(IP,12)=TSMNSP(IP,12)+NCTSP(IP)
  238*            ENCODE(84,9378,LINE) ICHAIN,IP,(CTSP(IP,IS),PRP(IS),IS=1,5),SUM,
  239*           1NCTSP(IP)
  240*            IBLK1=IBLK1+1
  241*     C      WRITE(3'IBLK1) LINE
  242*       455  CONTINUE
  243*     C         PRINT OUT EFFECTIVENESS BY HOUR DATA
  244*            WRITE(2,5) IDENT, IPAGE
  245*            IPAGE = IPAGE + 1
  246*            WRITE(2,460)
  247*       460 FORMAT(1H , //19X,29H----COMPONENTS----    EFFECT-,  /10X,
```

```
*RUNSUM***      ***RUNSUM***

248*            1  38HHOUR     THOR COMP RESP ACC    IVENESS)
249*              X = NSHIFT
250*              DO 470 IC = 1,5
251*              CH(IC) = 0.
252*          470 CONTINUE
253*              DO 500 IH = 1,IHMAX
254*              DO 480 IC = 1,5
255*              CEC(IH,IC) = CEC(IH,IC) / X
256*              CH(IC) = CH(IC) + CEC(IH,IC)
257*          480 CONTINUE
258*              WRITE(2,490) IH, (CEC(IH,IC), IC = 1,5)
259*          490 FORMAT(1H , I13, 4X, 4F5.2, F8.2)
260*          500 CONTINUE
261*              DO 510 IC = 1,5
262*              CH(IC) = CH(IC) / Q
263*          510 CONTINUE
264*              EXPR(2) = CH(5)
265*              WRITE(2,520) (CH(IC), IC= 1,5)
266*          520 FORMAT(1H ,/10X, 4HMEAN, 4X, 4F5.2, F8.2)
267*              IF(ICHAIN.EQ.0) GO TO 530
268*              DO 525 I=1,5
269*          525  COMMNS(I)=COMMNS(I)+CH(I)
270*              ENCODE(42,9525,LINE) ICHAIN,(CH(I),I=1,5)
271*         9525  FORMAT(10X,I4,4X,4F5.2,F8.2)
272*              IBLK1=IBLK1+1
273*        C     WRITE(3'IBLK1) LINE
274*          530  CONTINUE
275*        C       PRINT OUT WORKLOAD SUMMARY
276*              WRITE(2,5) IDENT, IPAGE
277*              IPAGE = IPAGE + 1
278*              WRITE(2,540)
279*          540 FORMAT(1H , 20X, 16HWORKLOAD SUMMARY  ,
280*             1 / 47X, 28H-------MESSAGE UNITS--------  ,
281*             2 / 11X, 31HBACKLOG      MESSAGES DELIVERED  ,
282*             3 38H    COMPLETED      REJECTED  INTERUPTED    ,
283*             4 /43H     HOUR  AO/G3  IOD  LAST 1/4 HR   ANYTIME    ,
284*             5 36H  AO/G3   IOD  AO/G3   IOD AO/G3 IOD   )
285*              DO 600 IH = 1, IHMAX
286*              WRITE(2, 560) IH
287*          560 FORMAT(1H , I5)
288*              X1  = LOGBAC(IH,1) / X
289*              X2 = LOGBAC(IH, 2) / X
290*              X3 = MUCOMP(IH,1) / X
291*              X4 = MUCOMP(IH,2) / X
292*              X5 = MUREJ(IH,1) / X
293*              X6 = MUREJ(IH,2) / X
294*              X7 = MUINT(IH,1) / X
295*              X8 = MUINT(IH,2) / X
296*              WRITE(2,590) X1,X2,IGP(IH),IGR(IH), X3,X4,X5,X6,X7,X8
297*          590 FORMAT(1H , F13.1, F6.1, I8,I11,F10.1,F7.1,F5.1,F7.1,F6.1,F5.1)
298*          600 CONTINUE
299*        C       PRINT ERROR SUMMARY
300*              WRITE(2,5) IDENT, IPAGE
301*              IPAGE = IPAGE + 1
302*              WRITE(2,620)
303*          620 FORMAT(1H , 20X, 23HERROR SUMMARY - BY HOUR//)
304*              WRITE(2,630)
```

```
*RUNSUM***      ***RUNSUM***

  305*      630 FORMAT(1H , 16X, 29H-------ERROR TYPE------      , 6X,
  306*          1 30HERROR   INFORMATION  NUMBER OF  ,
  307*          2 / 14X, 27H1          2          3       ,10H  4       ,
  308*          3  30HRETURNS     LOSS      MESSAGES   , /74X, 5HUNITS )
  309*           WRITE(2,640)
  310*      640 FORMAT(1H , 9H     HOUR  )
  311*           DO 700 IH = 1,IHMAX
  312*           IF( IRESH(7,IH) .LE. 0 ) GO TO 700
  313*           X = IRESH(7, IH)
  314*           DO 650 IET = 1,6
  315*           PRP(IET) = IRESH(IET, IH)
  316*           PRP(IET) = PRP(IET) / (X / 2.)
  317*      650 CONTINUE
  318*           WRITE(2,660) IH, (PRP(IET), IET= 1,6), IRESH(7,IH)
  319*      660 FORMAT(1H , I8, F8.4, 5F10.4, I11)
  320*      700 CONTINUE
  321*           WRITE(2,710)
  322*      710 FORMAT(1H ,///20X,31HERROR SUMMARY - BY MESSAGE TYPE   )
  323*           WRITE(2,630)
  324*           WRITE(2,720)
  325*      720 FORMAT(1H , 9H  MESSAGE, / 9H     TYPE  )
  326*     C     DO 800 IT = 1,7
  327*           DO 810  IT=1,7
  328*           IF( IREST(7, IT) .LE. 0) GO TO 800
  329*           X = IREST(7, IT)
  330*           DO 730 IET = 1,6
  331*           PRP(IET) = IREST(IET, IT)
  332*           PRP(IET) = PRP(IET) / (X / 2.)
  333*      730 CONTINUE
  334*           WRITE(2, 660) IT, (PRP(IET), IET= 1,6), IREST(7,IT)
  335*     C 800 CONTINUE
  336*       800   IF(ICHAIN.EQ.0) GO TO 810
  337*           DO 805 I=1,6
  338*       805  ERSUMT(IT,I)=ERSUMT(IT,I)+PRP(I)
  339*           ERSUMT(IT,7)=IREST(7,IT)+ERSUMT(IT,7)
  340*           ENCODE(54,9805,LINE) ICHAIN,IT,(PRP(I),I=1,6),IREST(7,IT)
  341*      9805  FORMAT(I3,I5,F8.4,5F10.4,I11)
  342*           IBLK1=IBLK1+1
  343*     C     WRITE(3'IBLK1) LINE
  344*       810  CONTINUE
  345*       825 RETURN
  346*           END

   ***SIMPAM***      ***SIMPAM***
```

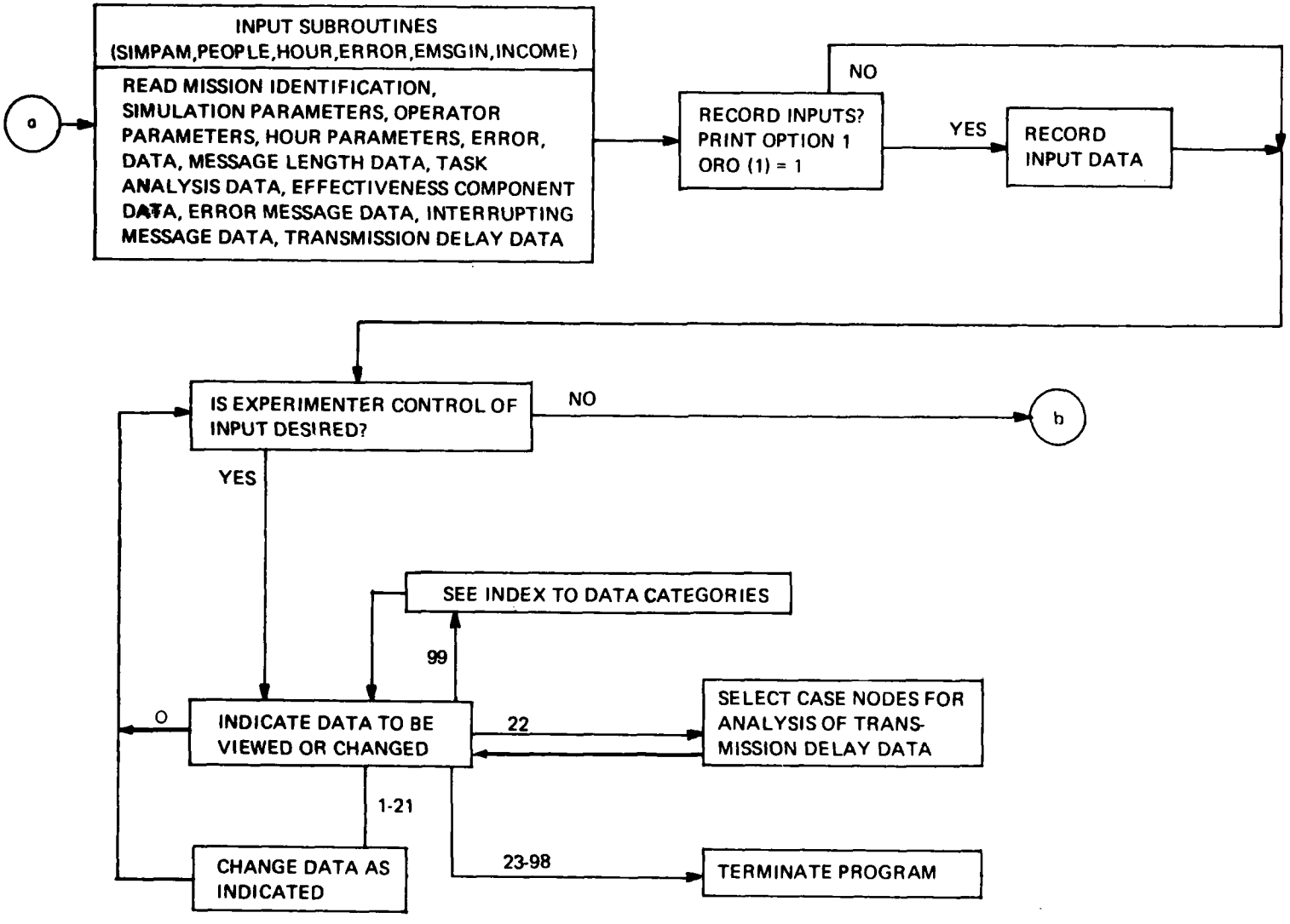
```
      SUBROUTINE SIMPAM
C        SIMULATIONS PARAMETERS ARE READ IN
      INCLUDE COMBLK
      READ(7,100)  IDENT
  100 FORMAT(12A6)
      READ(7,200)NSHIFT, IHMAX, MEN(1), MEN(2), NERROP, (ORO(L), L=1,9),
     2                                  IDAY, BKLG, PUL, PUS, SRTA, SRTS,
C     3 ((IATA(J,N), N= 1,8), J= 1,2),  NTE, Y
     3 ((IATA(J,N), N= 1,8), J= 1,2),  NTE, Y,ICHAIN,TZERO
  200  FORMAT(I3,I2,2I1,I1,1X,9A1,2I2,2X,4F5.3,16I1,I3,F8.8,4X,I1,F4.0)
C 200 FORMAT(I3, I2, 2I1, 2X, 6I1, 3X, 2I2, 2X, 4F5.3, 16I1, I3, A8)
      TZERO=TZERO*3600.
      PUL = PUL / 100.
      PUS = PUS/ 100.
      MEN(3)= MEN(1) + MEN(2)
      MENS = MEN(3)
C        ZERO RUN SUMMARY COUNTERS
      DO 220 IH = 1, IHMAX
      NCTSH(IH) = 0
        ERHR(IH) = 0.
        DURIN(IH) = 0.
        SDIN(IH) = 0.
        DEL(IH) = 0.
        DELSD(IH) = 0.
      DO 205 IES = 1,8
      IRESH(IES, IH) = 0
  205 CONTINUE
      DO 210 J = 1,2
      LOGRAC(IH,J) = 0
      MUCOMP(IH,J) = 0
      MUREJ(IH,J) = 0
      MUINT(IH,J) = 0
  210 CONTINUE
      DO 215 IC = 1,5
      CEC(IH,IC) = 0.
  215 CONTINUE
      DO 220 M = 1,MENS
      MGCP(IH,M) =    0
```

```
*SIMPAM***      ***SIMPAM***

      39*               CMTMG(IH,M) = 0.
      40*               CTWH(IH,M) = 0.
      41*               CIDH(IH,M) = 0.
      42*               CFS(IH,M) = 0.
      43*               CFA(IH,M) = 0.
      44*           220 CONTINUE
      45*               DO 230 IP = 1,5
      46*               NCTSP(IP) = 0
      47*               DO 229 IS = 1,5
      48*               CTSP(IP,IS) = 0.
      49*           229 CONTINUE
      50*           230 CONTINUE
      51*               DO 240 IT = 1,8
      52*               NCTST(IT) = 0
      53*               DO 239 IP = 1,5
      54*               CTST(IT,IP) = 0.
      55*           239 CONTINUE
      56*           240 CONTINUE
      57*               DO 245 IES = 1,8
      58*               DO 245 IT = 1,7
      59*               IREST(IES, IT) = 0
      60*           245 CONTINUE
      61*     C             PRINT SIMULATION PARAMETER INPUTS IF CALLED FOR
      62*               IF(QRO(1) .NE. CHAR(1)) GO TO 500
      63*               WRITE(2,250) IDENT, IPAGE
      64*           250 FORMAT(1H1, 15X, 12A6, 13X, 5HPAGE , I4/)
      65*               IPAGE = IPAGE + 1
      66*               WRITE(2,300)          NSHIFT, IDAY, IHMAX, BKLG, MEN(1), Y, MEN(2),
      67*              2 NERROP, PUL, SRTA, PUS ,  SRTS
      68*           300 FORMAT(1H ,
      69*              1 2X, 23HNO. OF SHIFT ITERATIONS, I13, 10X,
      70*              2 20HNO. OF SIMULATED DAY, I13/
      71*              3 3X, 22HNO. OF HOURS PER SHIFT, I14, 10X,
      72*              4 19HINITIAL BACKLOG '83, I14/
      73*              5 3X, 23HNO. OF ACTION OFFICIERS, 12X, I1,
      74*              5 10X, 13HRANDOM NUMBER, 12X, F10.8/
      75*              6 3X, 'ERROR MESSAGES', 18X, I1/
      76*              6 3X, 20HNO. OF IOD OPERATORS, 15X, I1//
      77*              7 3X, 38HPROBABILITY OF UNDETECTED ERROR IN CCC, 8X,
      78*              8 31HSYSTEM RESPONSE TIME TO INQUIRY/
      79*              9 10X, 14HLOW IMPORTANCE, F6.3,
      80*              A 26X, 4HMEAN, F7.3/
      81*              1 10X, 11HSIGNIFICANT, F9.3,
      82*              2 26X, 2HSD, F9.3//)
      83*           500 CONTINUE
      84*               RETURN
      85*               END

***SUMMER***      ***SUMMER***
```

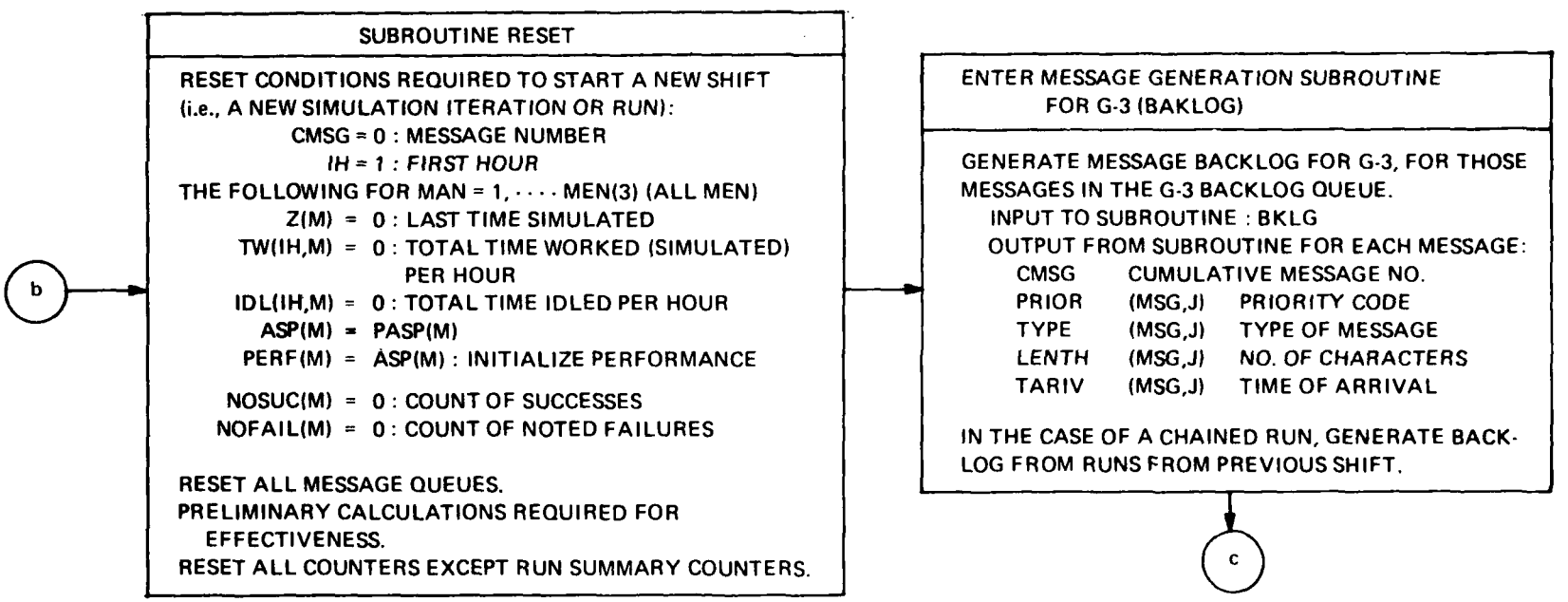
```
1*            SUBROUTINE SUMMER
2*            INCLUDE COMBLK
3*            PRINT 1000
4*      1000  FORMAT(22(1X/),
5*           1 ' [   ] DO YOU WANT A SIMULATION SUMMARY?')
6*            READ 2000, ANSW
7*      2000  FORMAT(2X,A3)
8*            IF( ANSW .EQ. ' NO' .OR. ANSW .EQ. 'NO ') GO TO 999
9*            PRINT 1010,NSHIFT,NCC,EXPR(1),EXPR(2), (M,MCL(M),
10*          1 EXTPM(M), EXASP(M), M=1,MENS)
11*     1010  FORMAT(22(1X/),
12*          1 /8X, 'AFTER', I4, ' ITERATIONS' //
13*          2 ' MESSAGES PROCESSED  =',I8/
14*          3 ' AVG TIME PER MESSAGE= ', F8.1/
15*          4 ' EFFECTIVENESS       =' ,F8.3/
16*          5 ' MAN  MSGS  AVG TIME/MSG    ASP' /
17*          6 6(I3, I6, F14.1, F7.3/))
18*           READ 2000, ANSW
19*     50    CONTINUE
20*           PRINT 1020
21*     1020  FORMAT(22(1X/),
22*          1 ' [   ] WHICH HOUR SUMMARY DO YOU WANT?')
23*           READ 2010,L
24*     2010  FORMAT(2X, I2)
25*           IF( L .LE. 0) GO TO 999
26*           PRINT 1030, L,NSHIFT,MUCOMP(L,2),(M,MGCP(L,M),
27*          1 EXTPMH(L,M), EXASPH(L,M),M=1,MENS)
28*     1030  FORMAT(22(1X/),
29*          1 /5X, 'HOUR', I3, ' AFTER', I4, ' ITERATIONS.' //
30*          2 ' MESSAGES PROCESSED  =' , I8, ///
31*          3 ' MAN  MSGS  AVG TIME/MSG    ASP' /
32*          4 6(I3, I6, F14.1, F7.3/))
33*           READ 2000, ANSW
34*           GO TO 50
35*      999  CONTINUE
36*           RETURN
37*           END
```

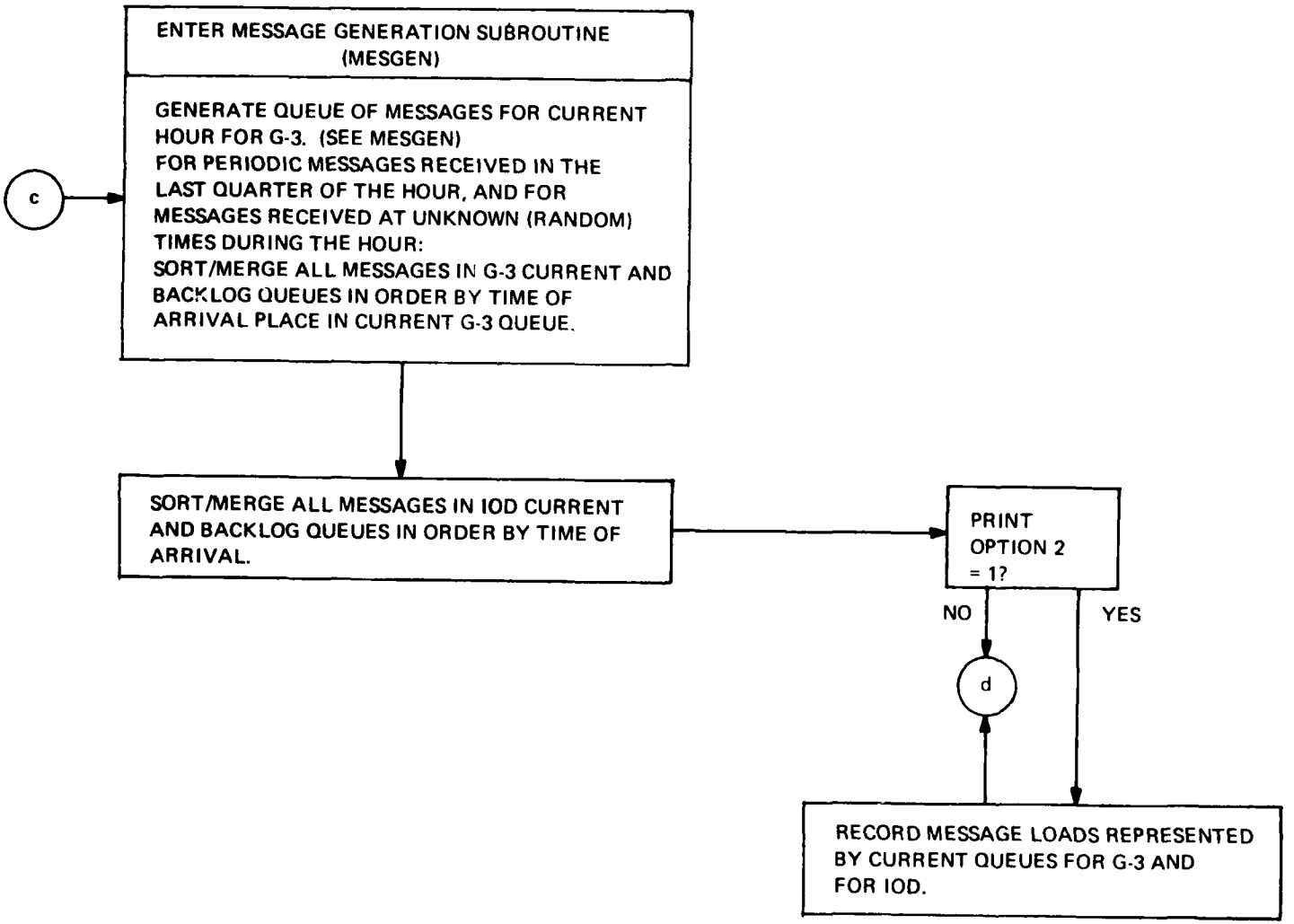
APPENDIX C

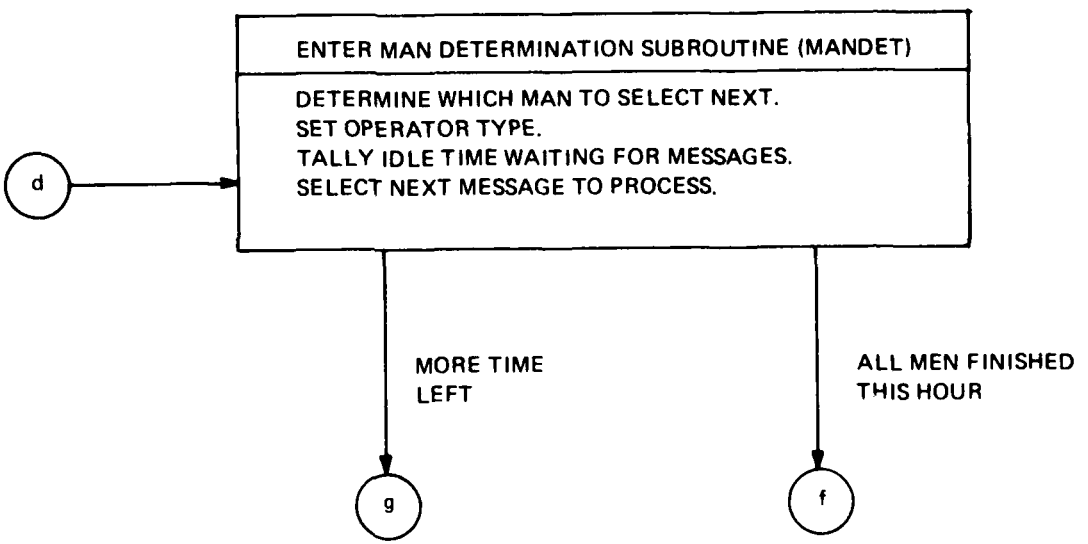
Flow Charts

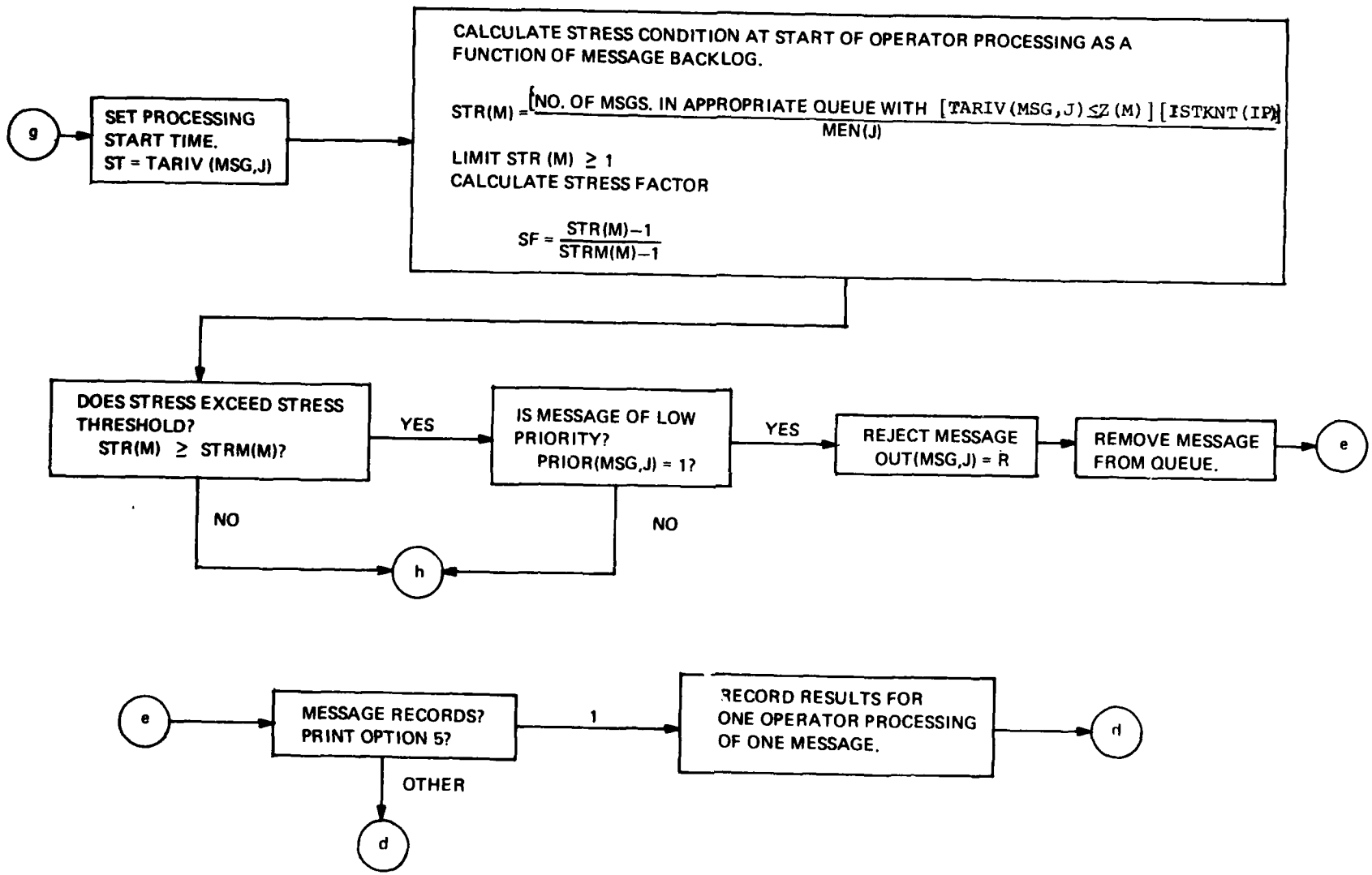


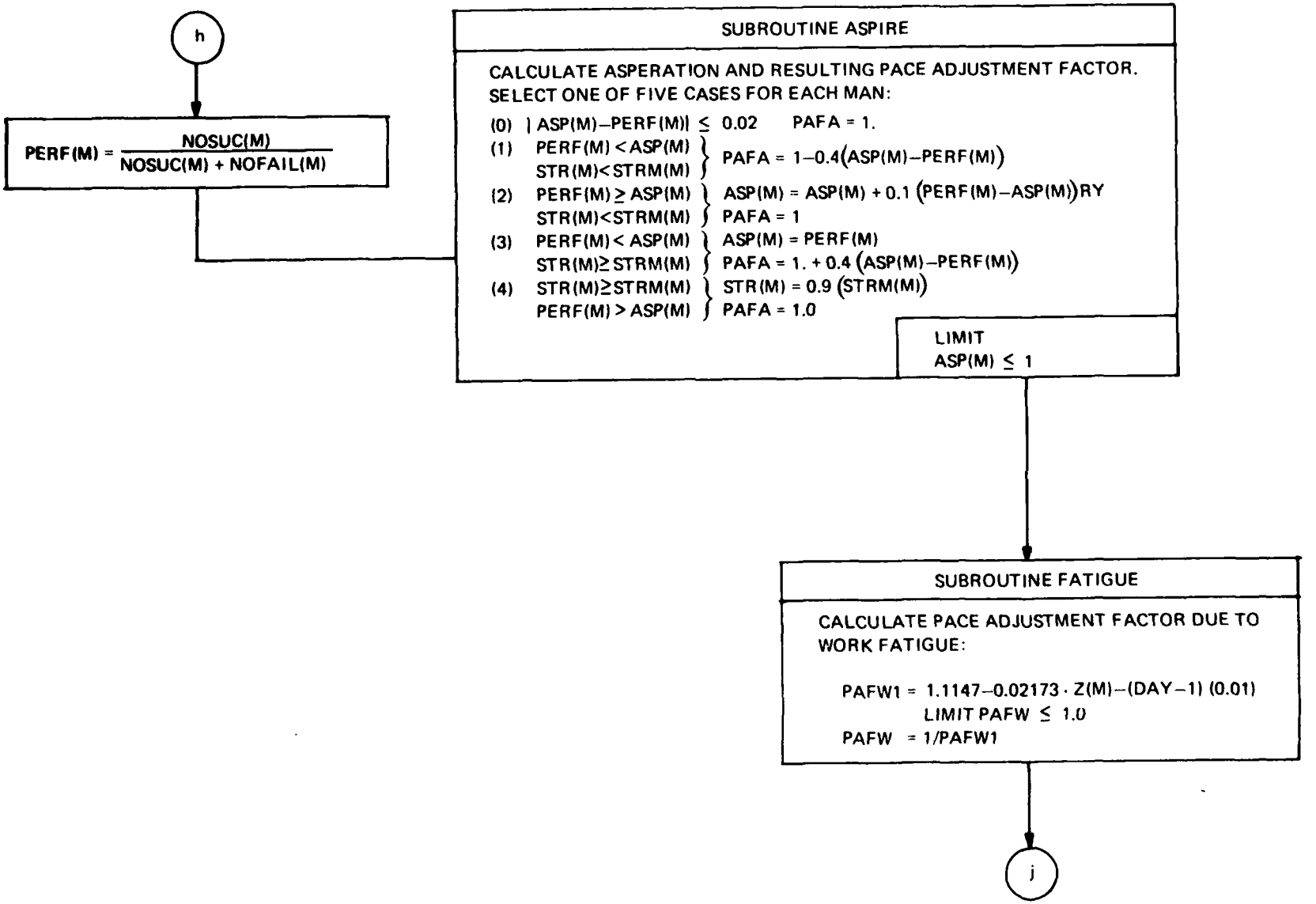
MAIN SEQUENCE LOGIC FLOW FOR MANMOD
(ROUTINE SIPS)

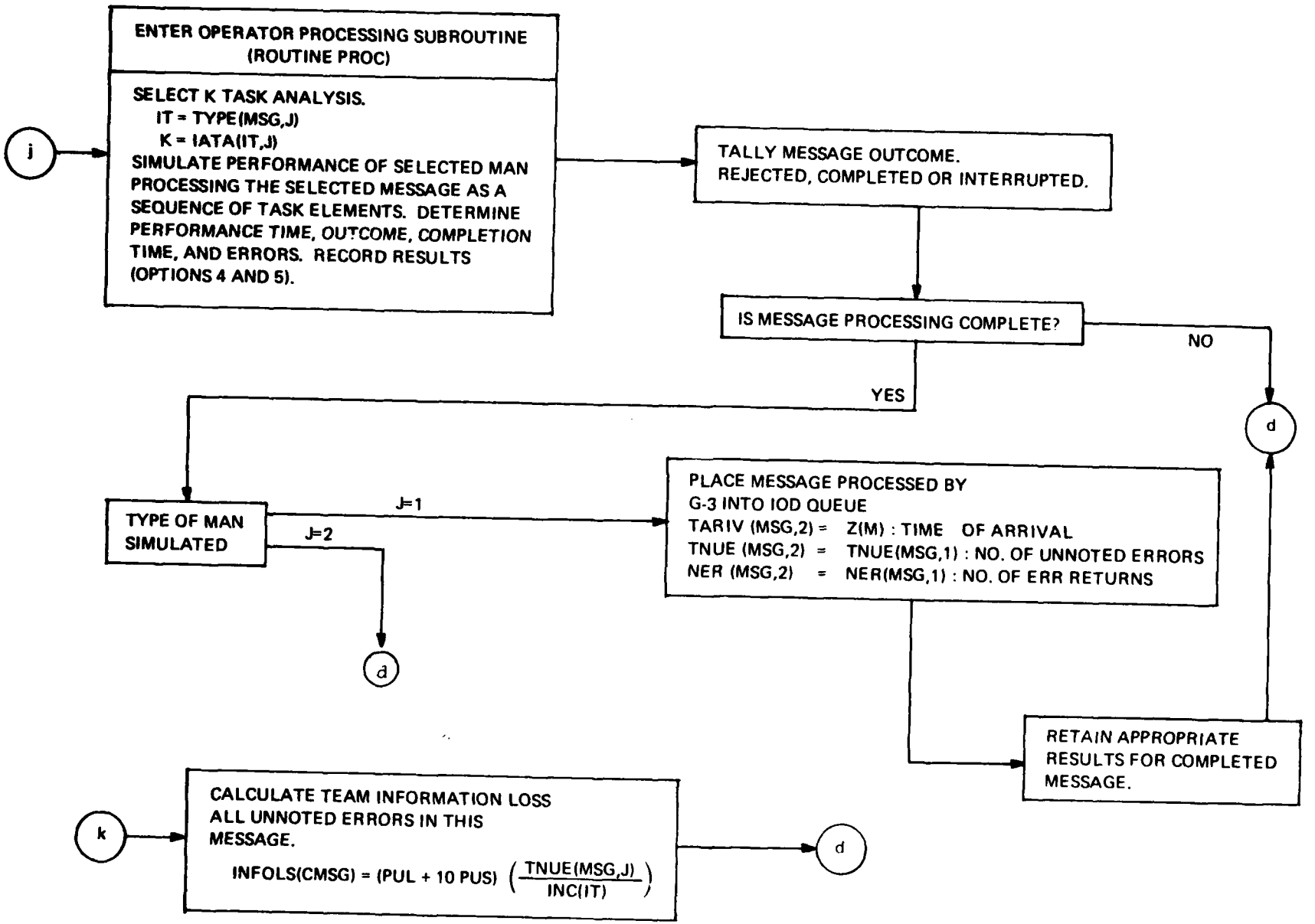

b
SUBROUTINE RESET
RESET CONDITIONS REQUIRED TO START A NEW SHIFT
(i.e., A NEW SIMULATION ITERATION OR RUN):
CMSG = 0 : MESSAGE NUMBER
IH = 1 : FIRST HOUR
THE FOLLOWING FOR MAN = 1, · · · · MEN(3) (ALL MEN)
Z(M) = 0 : LAST TIME SIMULATED
TW(IH,M) = 0 : TOTAL TIME WORKED (SIMULATED) PER HOUR
IDL(IH,M) = 0 : TOTAL TIME IDLED PER HOUR
ASP(M) = PASP(M)
PERF(M) = ASP(M) : INITIALIZE PERFORMANCE
NOSUC(M) = 0 : COUNT OF SUCCESSES
NOFAIL(M) = 0 : COUNT OF NOTED FAILURES
RESET ALL MESSAGE QUEUES.
PRELIMINARY CALCULATIONS REQUIRED FOR EFFECTIVENESS.
RESET ALL COUNTERS EXCEPT RUN SUMMARY COUNTERS.
ENTER MESSAGE GENERATION SUBROUTINE FOR G-3 (BAKLOG)
GENERATE MESSAGE BACKLOG FOR G-3, FOR THOSE MESSAGES IN THE G-3 BACKLOG QUEUE.
INPUT TO SUBROUTINE : BKLG
OUTPUT FROM SUBROUTINE FOR EACH MESSAGE:
CMSG CUMULATIVE MESSAGE NO.
PRIOR (MSG,J) PRIORITY CODE
TYPE (MSG,J) TYPE OF MESSAGE
LENTH (MSG,J) NO. OF CHARACTERS
TARIV (MSG,J) TIME OF ARRIVAL
IN THE CASE OF A CHAINED RUN, GENERATE BACKLOG FROM RUNS FROM PREVIOUS SHIFT.
c

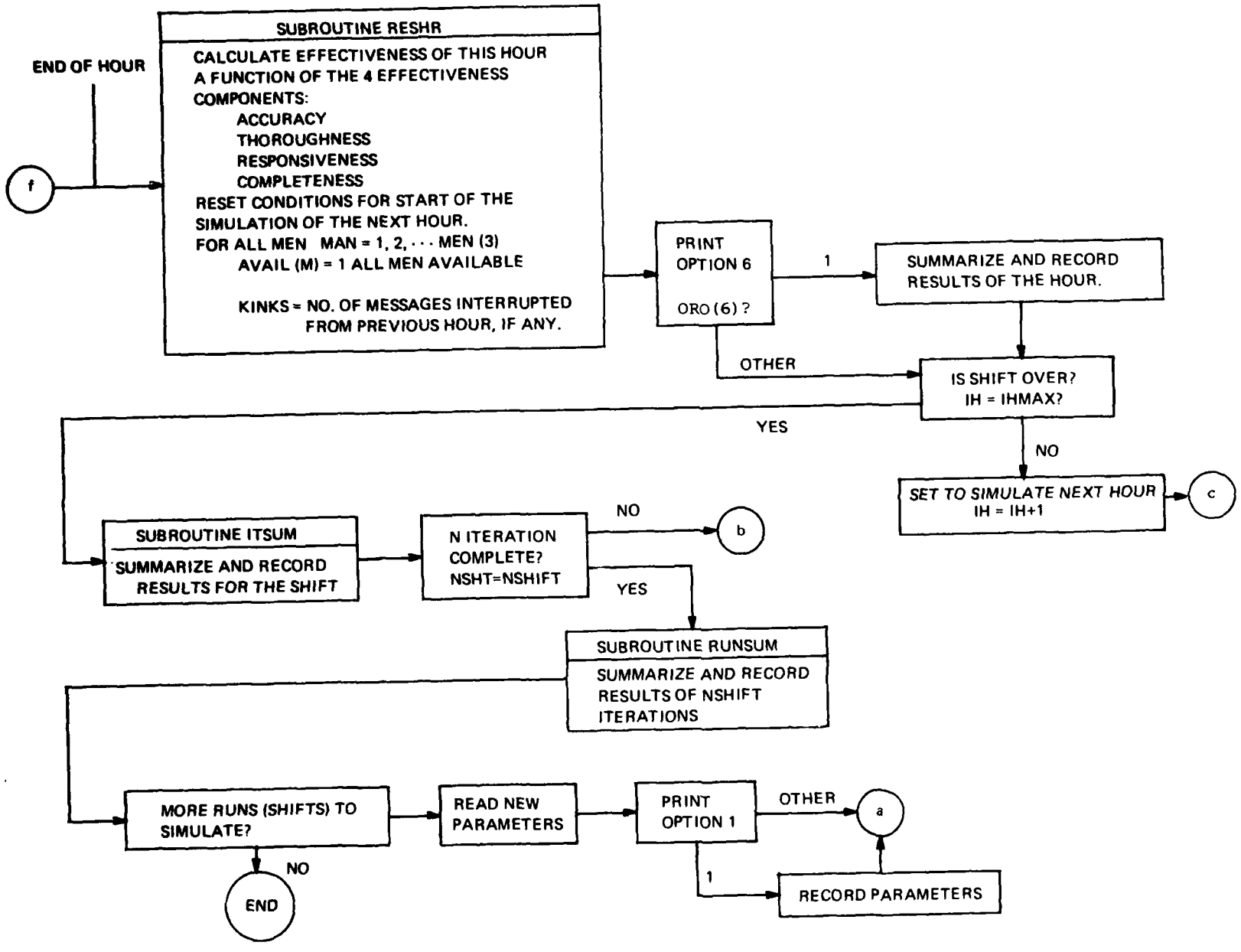

ENTER MESSAGE GENERATION SUBROUTINE (MESGEN)
GENERATE QUEUE OF MESSAGES FOR CURRENT HOUR FOR G-3. (SEE MESGEN)
FOR PERIODIC MESSAGES RECEIVED IN THE LAST QUARTER OF THE HOUR, AND FOR MESSAGES RECEIVED AT UNKNOWN (RANDOM) TIMES DURING THE HOUR:
SORT/MERGE ALL MESSAGES IN G-3 CURRENT AND BACKLOG QUEUES IN ORDER BY TIME OF ARRIVAL PLACE IN CURRENT G-3 QUEUE.
c
SORT/MERGE ALL MESSAGES IN IOD CURRENT AND BACKLOG QUEUES IN ORDER BY TIME OF ARRIVAL.
PRINT OPTION 2 = 1?
NO
YES
d
RECORD MESSAGE LOADS REPRESENTED BY CURRENT QUEUES FOR G-3 AND FOR IOD.


ENTER MAN DETERMINATION SUBROUTINE (MANDET)
DETERMINE WHICH MAN TO SELECT NEXT.
SET OPERATOR TYPE.
TALLY IDLE TIME WAITING FOR MESSAGES.
SELECT NEXT MESSAGE TO PROCESS.
d
MORE TIME LEFT
ALL MEN FINISHED THIS HOUR
g
f

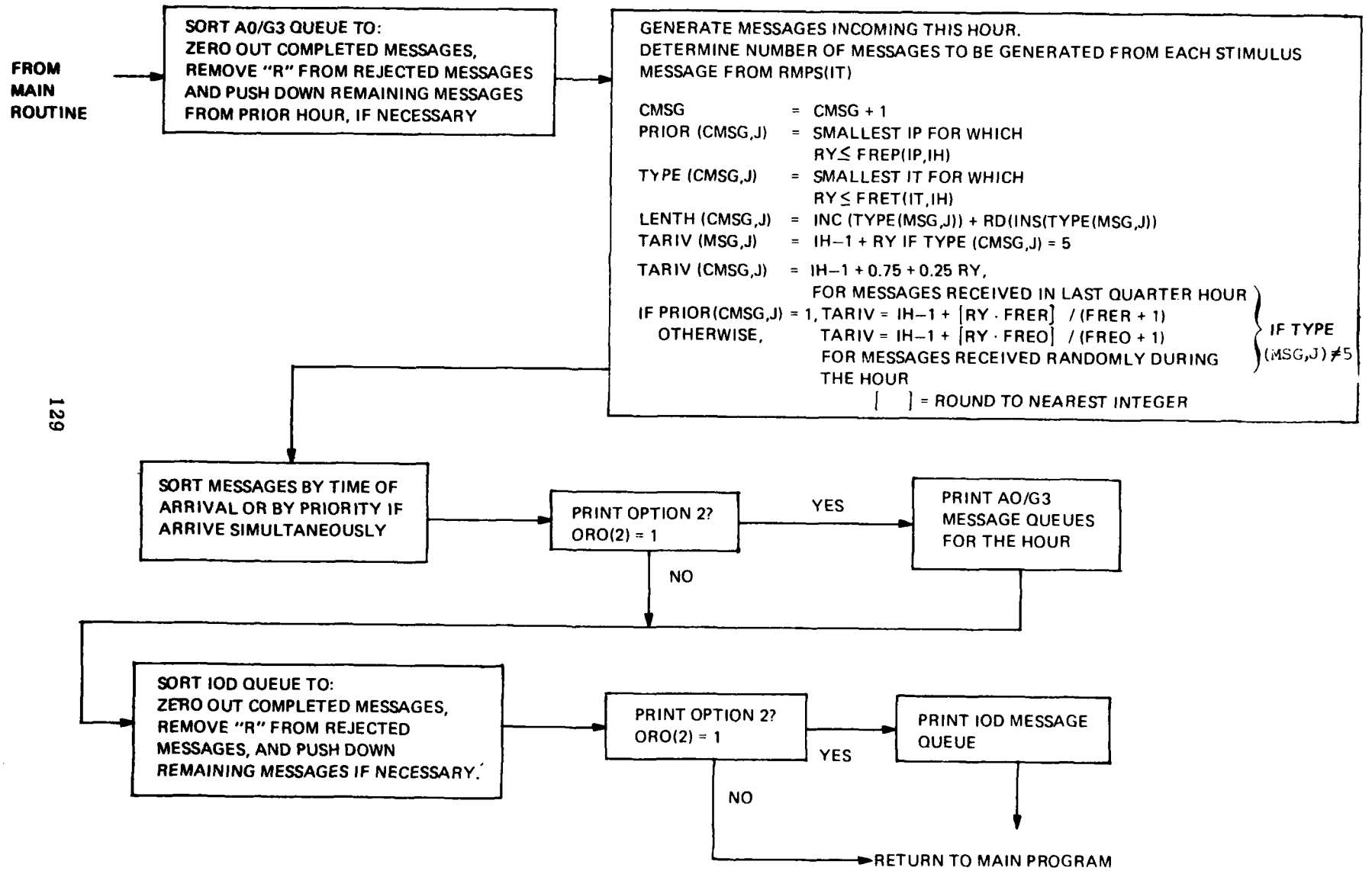

g
SET PROCESSING START TIME.
ST = TARIV (MSG,J)
CALCULATE STRESS CONDITION AT START OF OPERATOR PROCESSING AS A FUNCTION OF MESSAGE BACKLOG.
STR(M) = [NO. OF MSGS. IN APPROPRIATE QUEUE WITH [TARIV(MSG,J) ≤ Z(M)] [ISTKNT(IP)]] / MEN(J)
LIMIT STR (M) ≥ 1
CALCULATE STRESS FACTOR
SF = (STR(M)−1) / (STRM(M)−1)
DOES STRESS EXCEED STRESS THRESHOLD?
STR(M) ≥ STRM(M)?
YES
IS MESSAGE OF LOW PRIORITY?
PRIOR(MSG,J) = 1?
YES
REJECT MESSAGE
OUT(MSG,J) = R
REMOVE MESSAGE FROM QUEUE.
e
NO
NO
h
e
MESSAGE RECORDS?
PRINT OPTION 5?
1
RECORD RESULTS FOR ONE OPERATOR PROCESSING OF ONE MESSAGE.
d
OTHER
d


h
PERF(M) = NOSUC(M) / NOSUC(M) + NOFAIL(M)
SUBROUTINE ASPIRE
CALCULATE ASPERATION AND RESULTING PACE ADJUSTMENT FACTOR.
SELECT ONE OF FIVE CASES FOR EACH MAN:
(0) | ASP(M)−PERF(M)| ≤ 0.02 PAFA = 1.
(1) PERF(M) < ASP(M)
STR(M)< STRM(M)
PAFA = 1−0.4(ASP(M)−PERF(M))
(2) PERF(M) ≥ ASP(M)
STR(M)<STRM(M)
ASP(M) = ASP(M) + 0.1 (PERF(M)−ASP(M))RY
PAFA = 1
(3) PERF(M) < ASP(M)
STR(M)≥ STRM(M)
ASP(M) = PERF(M)
PAFA = 1. + 0.4 (ASP(M)−PERF(M))
(4) STR(M)≥STRM(M)
PERF(M) > ASP(M)
STR(M) = 0.9 (STRM(M))
PAFA = 1.0
LIMIT
ASP(M) ≤ 1
SUBROUTINE FATIGUE
CALCULATE PACE ADJUSTMENT FACTOR DUE TO
WORK FATIGUE:
PAFW1 = 1.1147−0.02173 · Z(M)−(DAY−1) (0.01)
LIMIT PAFW ≤ 1.0
PAFW = 1/PAFW1
j


ENTER OPERATOR PROCESSING SUBROUTINE (ROUTINE PROC)
SELECT K TASK ANALYSIS.
IT = TYPE(MSG,J)
K = IATA(IT,J)
SIMULATE PERFORMANCE OF SELECTED MAN PROCESSING THE SELECTED MESSAGE AS A SEQUENCE OF TASK ELEMENTS. DETERMINE PERFORMANCE TIME, OUTCOME, COMPLETION TIME, AND ERRORS. RECORD RESULTS (OPTIONS 4 AND 5).
j
TALLY MESSAGE OUTCOME. REJECTED, COMPLETED OR INTERRUPTED.
IS MESSAGE PROCESSING COMPLETE?
NO
YES
d
TYPE OF MAN SIMULATED
J=1
J=2
d
PLACE MESSAGE PROCESSED BY G-3 INTO IOD QUEUE
TARIV (MSG,2) = Z(M) : TIME OF ARRIVAL
TNUE (MSG,2) = TNUE(MSG,1) : NO. OF UNNOTED ERRORS
NER (MSG,2) = NER(MSG,1) : NO. OF ERR RETURNS
RETAIN APPROPRIATE RESULTS FOR COMPLETED MESSAGE.
k
CALCULATE TEAM INFORMATION LOSS ALL UNNOTED ERRORS IN THIS MESSAGE.
INFOLS(CMSG) = (PUL + 10 PUS) (TNUE(MSG,J) / INC(IT))
d


END OF HOUR
f
SUBROUTINE RESHR
CALCULATE EFFECTIVENESS OF THIS HOUR A FUNCTION OF THE 4 EFFECTIVENESS COMPONENTS:
ACCURACY
THOROUGHNESS
RESPONSIVENESS
COMPLETENESS
RESET CONDITIONS FOR START OF THE SIMULATION OF THE NEXT HOUR.
FOR ALL MEN MAN = 1, 2, · · · MEN (3)
AVAIL (M) = 1 ALL MEN AVAILABLE
KINKS = NO. OF MESSAGES INTERRUPTED FROM PREVIOUS HOUR, IF ANY.
PRINT OPTION 6
ORO (6) ?
1
SUMMARIZE AND RECORD RESULTS OF THE HOUR.
OTHER
IS SHIFT OVER? IH = IHMAX?
YES
NO
SET TO SIMULATE NEXT HOUR IH = IH+1
c
SUBROUTINE ITSUM
SUMMARIZE AND RECORD RESULTS FOR THE SHIFT
N ITERATION COMPLETE? NSHT=NSHIFT
NO
b
YES
SUBROUTINE RUNSUM
SUMMARIZE AND RECORD RESULTS OF NSHIFT ITERATIONS
MORE RUNS (SHIFTS) TO SIMULATE?
NO
END
READ NEW PARAMETERS
PRINT OPTION 1
OTHER
a
1
RECORD PARAMETERS

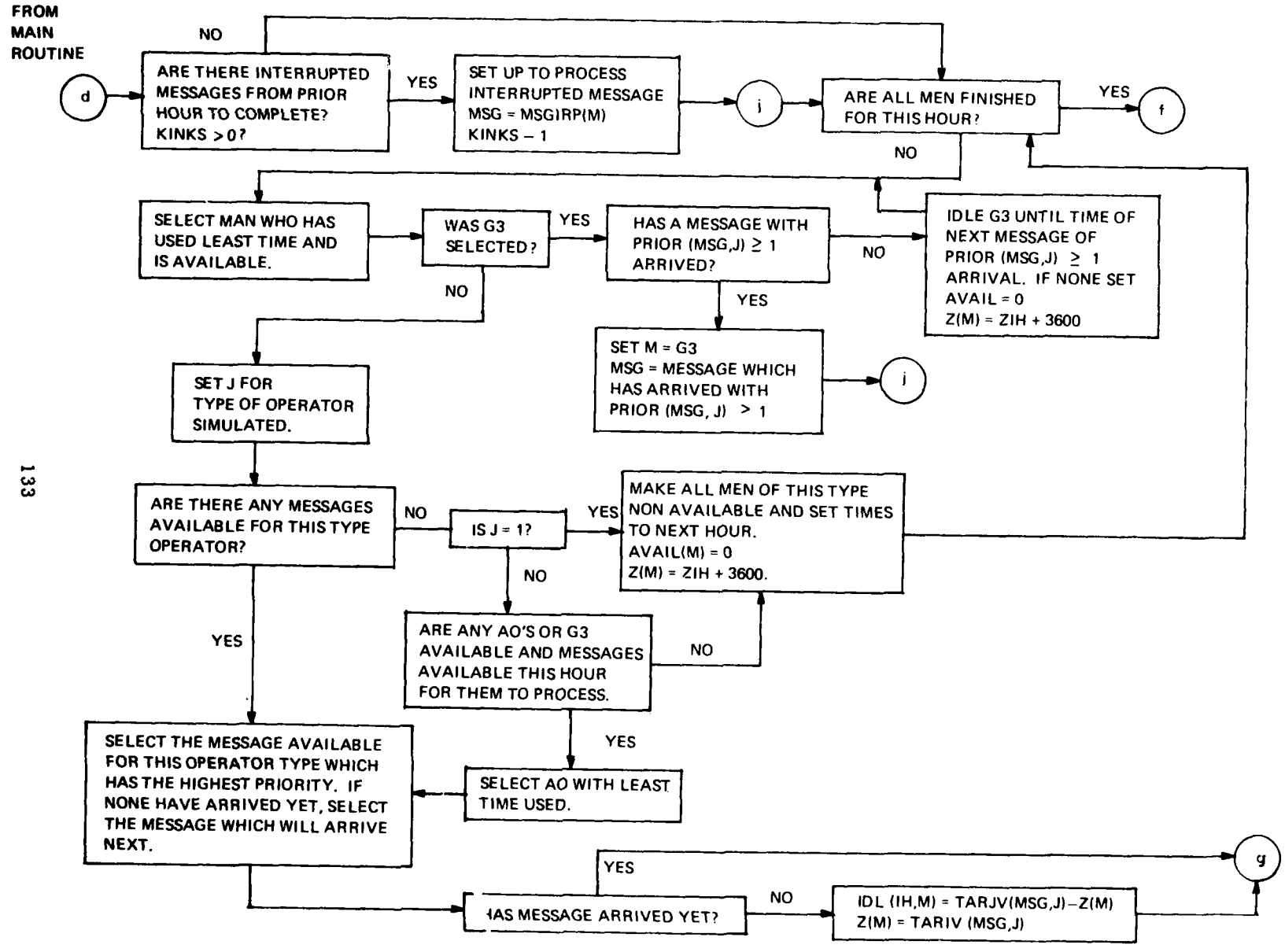
Message Generation Subroutine



MESSAGE GENERATION SUBROUTINE (MESGEN)

Man Determination Subroutine

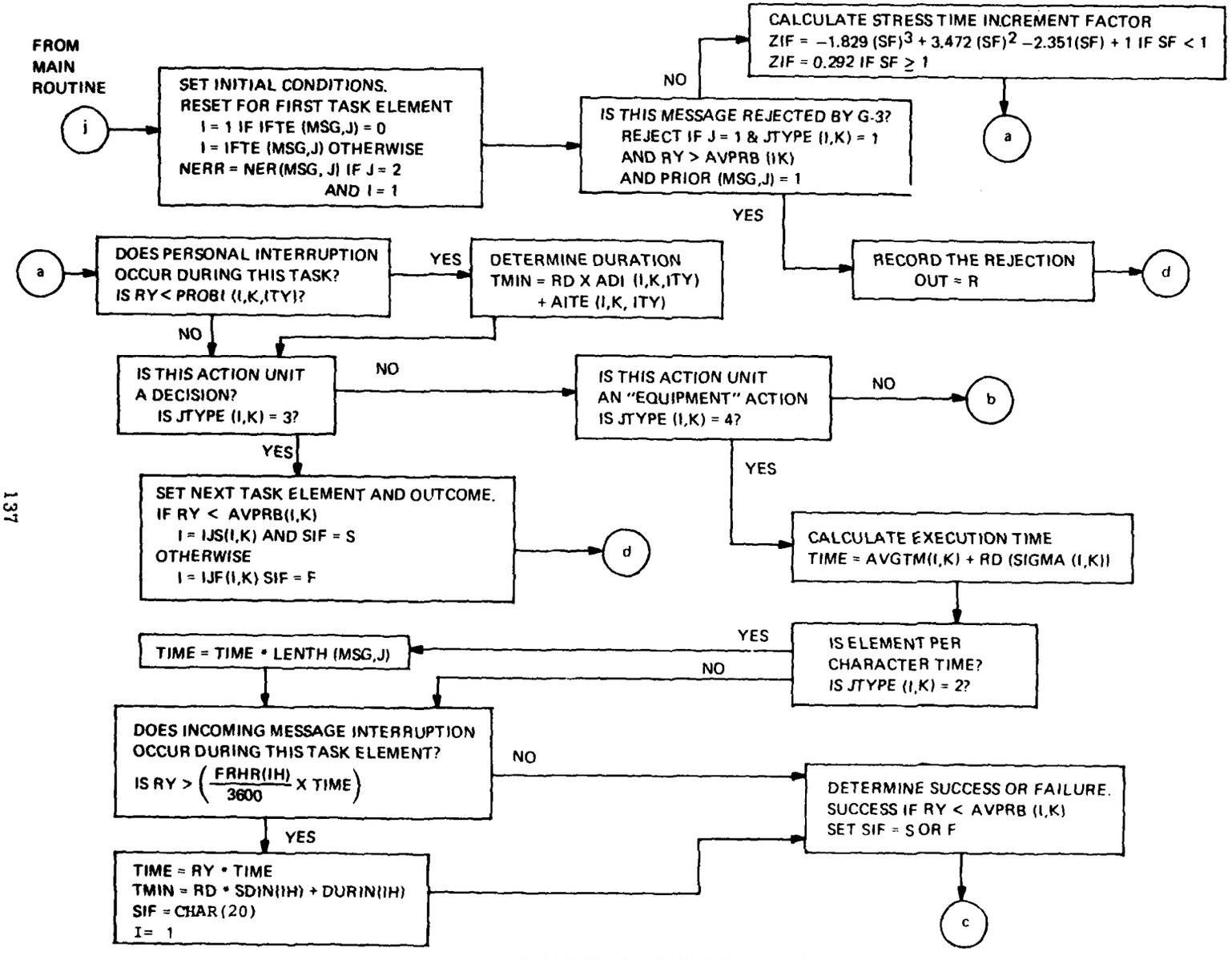
Note: All circled letters refer to main logic flow.



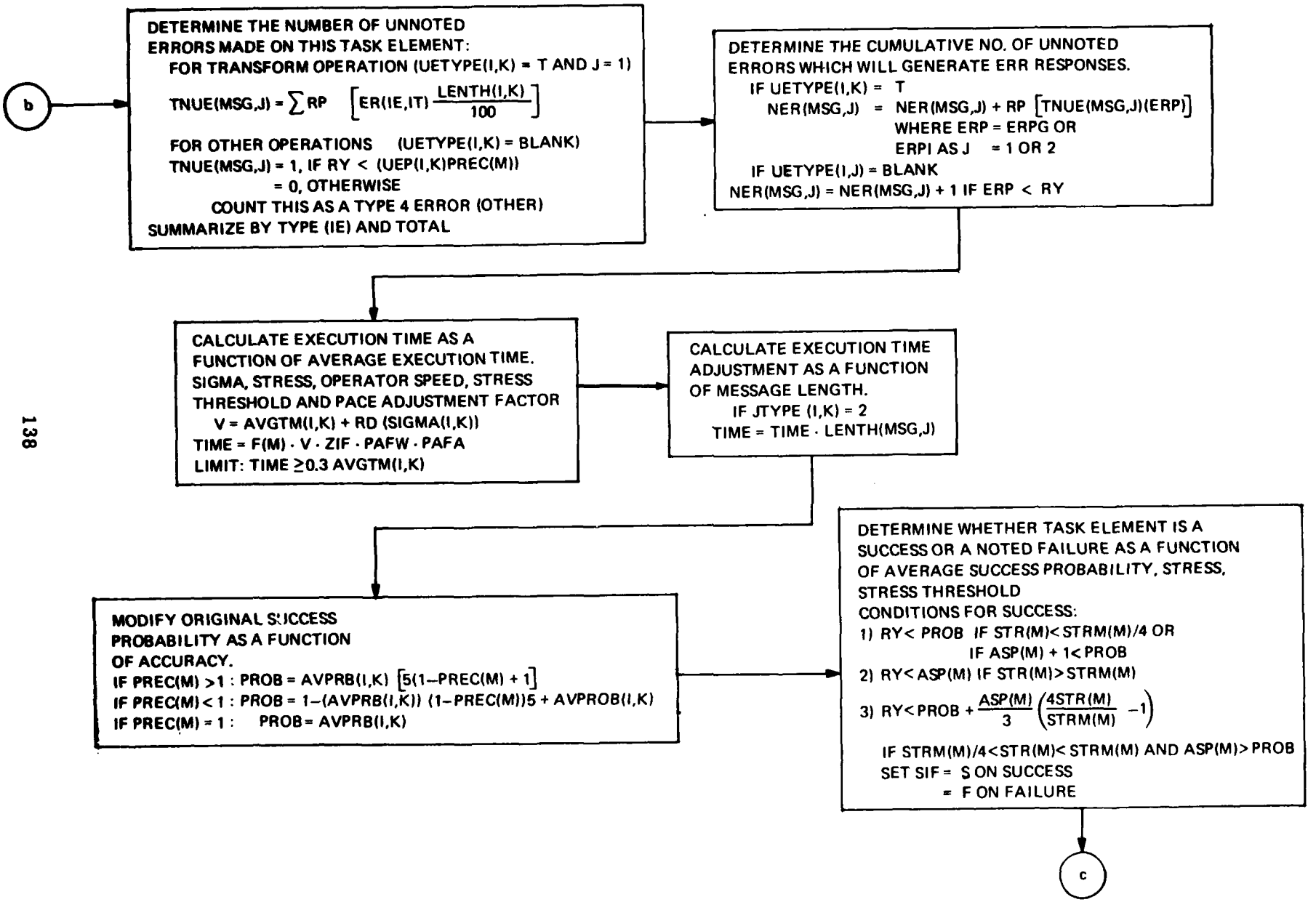
MAN DETERMINATION SUBROUTINE (MANDET)

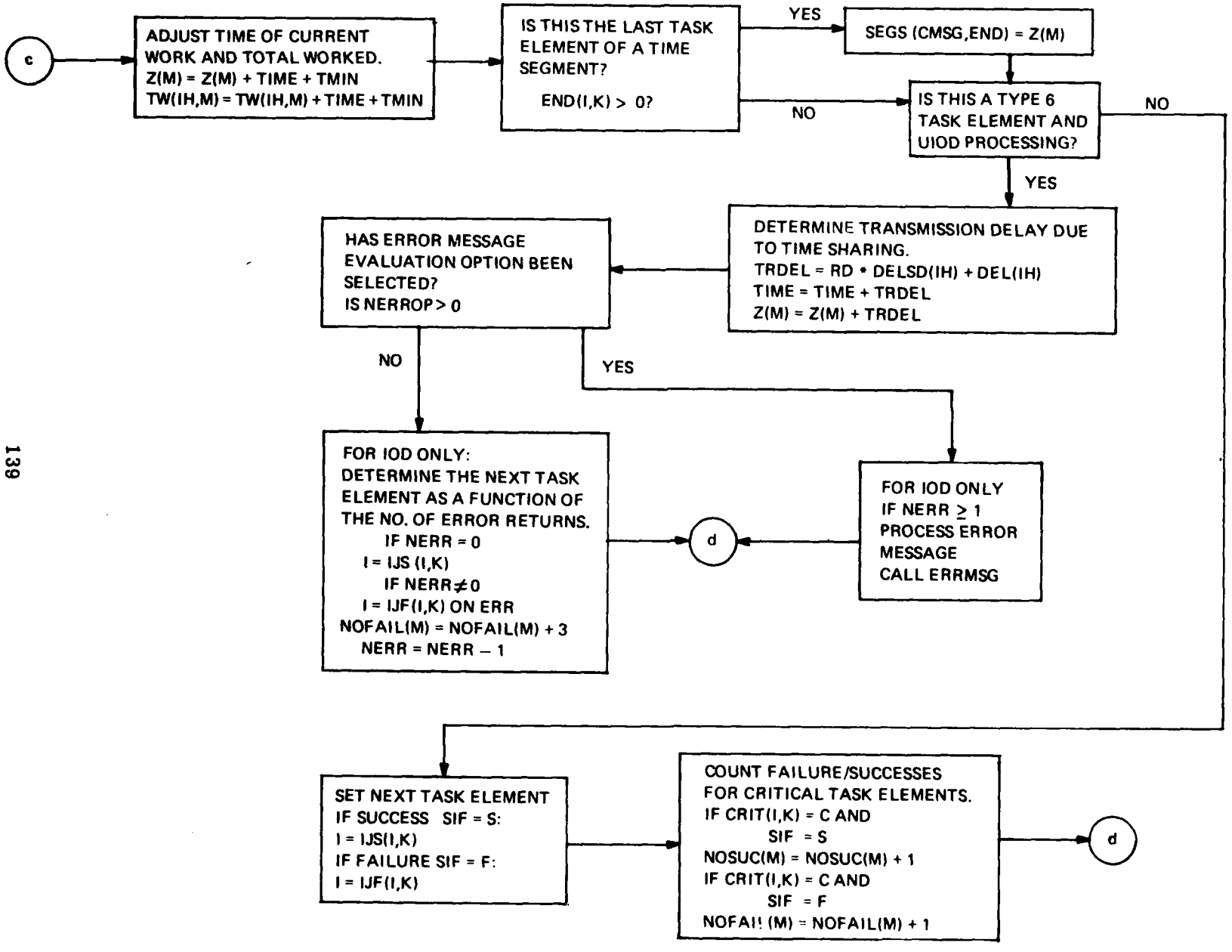
Operator Processing Subroutine

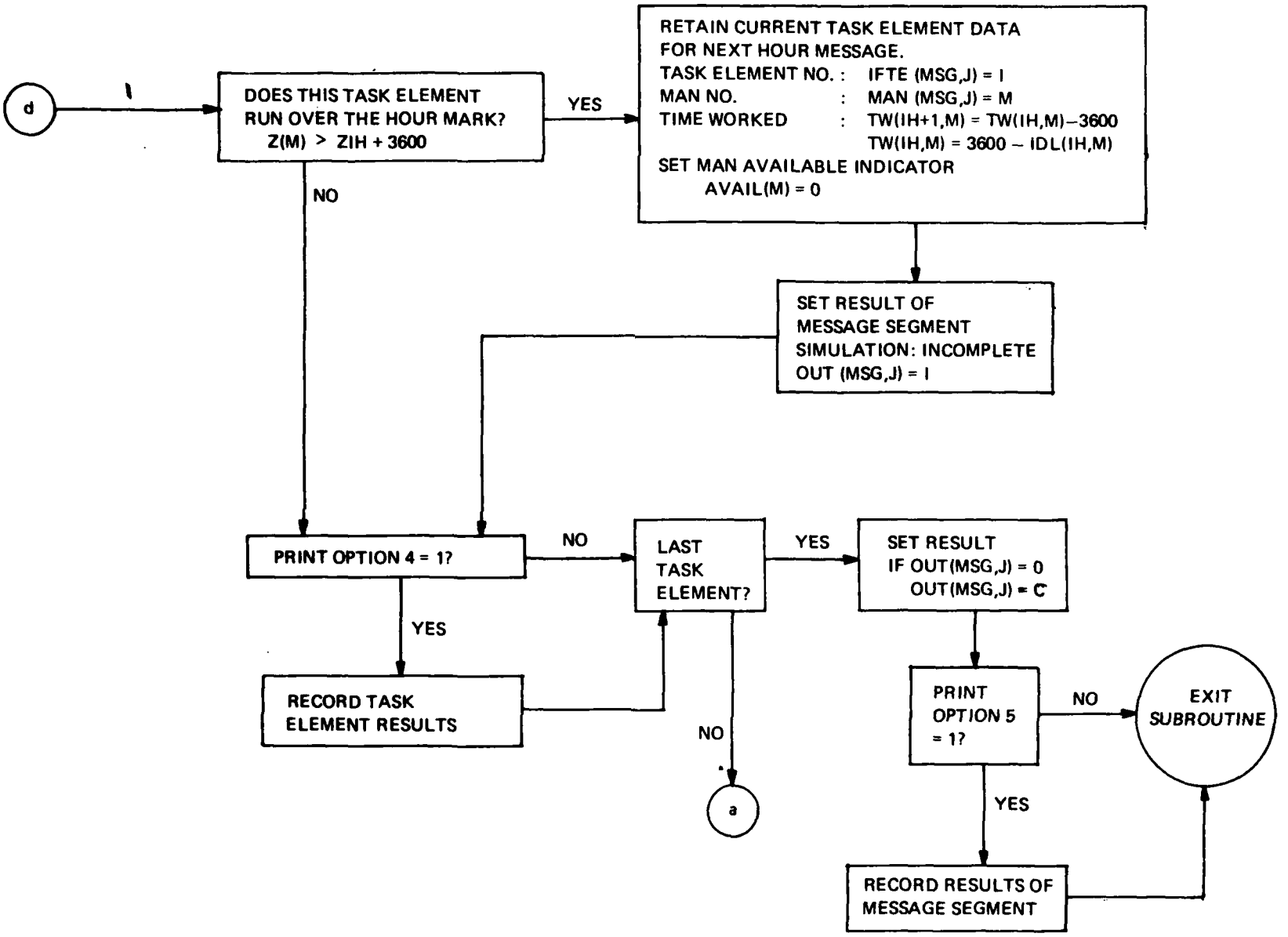
Note: All circled letters (except j) refer to logic points internal to this subroutine.



OPERATOR PROCESSING SUBROUTINE


b
DETERMINE THE NUMBER OF UNNOTED ERRORS MADE ON THIS TASK ELEMENT:
FOR TRANSFORM OPERATION (UETYPE(I,K) = T AND J = 1)
TNUE(MSG,J) = ∑RP [ER(IE,IT) LENTH(I,K) / 100]
FOR OTHER OPERATIONS (UETYPE(I,K) = BLANK)
TNUE(MSG,J) = 1, IF RY < (UEP(I,K)PREC(M))
= 0, OTHERWISE
COUNT THIS AS A TYPE 4 ERROR (OTHER)
SUMMARIZE BY TYPE (IE) AND TOTAL
DETERMINE THE CUMULATIVE NO. OF UNNOTED ERRORS WHICH WILL GENERATE ERR RESPONSES.
IF UETYPE(I,K) = T
NER(MSG,J) = NER(MSG,J) + RP [TNUE(MSG,J)(ERP)]
WHERE ERP = ERPG OR
ERPI AS J = 1 OR 2
IF UETYPE(I,J) = BLANK
NER(MSG,J) = NER(MSG,J) + 1 IF ERP < RY
CALCULATE EXECUTION TIME AS A FUNCTION OF AVERAGE EXECUTION TIME. SIGMA, STRESS, OPERATOR SPEED, STRESS THRESHOLD AND PACE ADJUSTMENT FACTOR
V = AVGTM(I,K) + RD (SIGMA(I,K))
TIME = F(M) · V · ZIF · PAFW · PAFA
LIMIT: TIME ≥0.3 AVGTM(I,K)
CALCULATE EXECUTION TIME ADJUSTMENT AS A FUNCTION OF MESSAGE LENGTH.
IF JTYPE (I,K) = 2
TIME = TIME · LENTH(MSG,J)
MODIFY ORIGINAL SUCCESS PROBABILITY AS A FUNCTION OF ACCURACY.
IF PREC(M) >1 : PROB = AVPRB(I,K) [5(1–PREC(M) + 1]
IF PREC(M) < 1 : PROB = 1–(AVPRB(I,K)) (1–PREC(M))5 + AVPROB(I,K)
IF PREC(M) = 1 : PROB = AVPRB(I,K)
DETERMINE WHETHER TASK ELEMENT IS A SUCCESS OR A NOTED FAILURE AS A FUNCTION OF AVERAGE SUCCESS PROBABILITY, STRESS, STRESS THRESHOLD
CONDITIONS FOR SUCCESS:
1) RY< PROB IF STR(M)< STRM(M)/4 OR
IF ASP(M) + 1< PROB
2) RY< ASP(M) IF STR(M)> STRM(M)
3) RY< PROB + ASP(M)/3 (4STR(M)/STRM(M) –1)
IF STRM(M)/4<STR(M)< STRM(M) AND ASP(M)> PROB
SET SIF = S ON SUCCESS
= F ON FAILURE
c


c
ADJUST TIME OF CURRENT WORK AND TOTAL WORKED.
Z(M) = Z(M) + TIME + TMIN
TW(IH,M) = TW(IH,M) + TIME + TMIN
IS THIS THE LAST TASK ELEMENT OF A TIME SEGMENT?
END(I,K) > 0?
YES
SEGS (CMSG,END) = Z(M)
NO
IS THIS A TYPE 6 TASK ELEMENT AND UIOD PROCESSING?
NO
YES
DETERMINE TRANSMISSION DELAY DUE TO TIME SHARING.
TRDEL = RD * DELSD(IH) + DEL(IH)
TIME = TIME + TRDEL
Z(M) = Z(M) + TRDEL
HAS ERROR MESSAGE EVALUATION OPTION BEEN SELECTED?
IS NERROP > 0
NO
YES
FOR IOD ONLY:
DETERMINE THE NEXT TASK ELEMENT AS A FUNCTION OF THE NO. OF ERROR RETURNS.
IF NERR = 0
I = IJS (I,K)
IF NERR≠0
I = IJF(I,K) ON ERR
NOFAIL(M) = NOFAIL(M) + 3
NERR = NERR – 1
d
FOR IOD ONLY
IF NERR ≥ 1
PROCESS ERROR MESSAGE
CALL ERRMSG
SET NEXT TASK ELEMENT
IF SUCCESS SIF = S:
I = IJS(I,K)
IF FAILURE SIF = F:
I = IJF(I,K)
COUNT FAILURE/SUCCESSES FOR CRITICAL TASK ELEMENTS.
IF CRIT(I,K) = C AND
SIF = S
NOSUC(M) = NOSUC(M) + 1
IF CRIT(I,K) = C AND
SIF = F
NOFAIL (M) = NOFAIL(M) + 1
d


d
DOES THIS TASK ELEMENT RUN OVER THE HOUR MARK? Z(M) > ZIH + 3600
YES
RETAIN CURRENT TASK ELEMENT DATA FOR NEXT HOUR MESSAGE.
TASK ELEMENT NO. : IFTE (MSG,J) = I
MAN NO. : MAN (MSG,J) = M
TIME WORKED : TW(IH+1,M) = TW(IH,M)–3600
TW(IH,M) = 3600 – IDL(IH,M)
SET MAN AVAILABLE INDICATOR AVAIL(M) = 0
NO
SET RESULT OF MESSAGE SEGMENT SIMULATION: INCOMPLETE OUT (MSG,J) = I
PRINT OPTION 4 = 1?
NO
LAST TASK ELEMENT?
YES
SET RESULT IF OUT(MSG,J) = 0 OUT(MSG,J) = C
YES
RECORD TASK ELEMENT RESULTS
NO
a
PRINT OPTION 5 = 1?
NO
EXIT SUBROUTINE
YES
RECORD RESULTS OF MESSAGE SEGMENT

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1 USAIMA, Ft Bragg, ATTN: Marquat Lib
1 US WAC Ctr & Sch, Ft McClellan, ATTN: Lib
1 US WAC Ctr & Sch, Ft McClellan, ATTN: Tng Dir
1 USA Quartermaster Sch, Ft Lee, ATTN: ATSM-TE
1 Intelligence Material Dev Ofc, EWL, Ft Holabird
1 USA SE Signal Sch, Ft Gordon, ATTN: ATSO-EA
1 USA Chaplain Ctr & Sch, Ft Hamilton, ATTN: ATSC-TE-RD
1 USATSCH, Ft Eustis, ATTN: Educ Advisor
1 USA War College, Carlisle Barracks, ATTN: Lib
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1 FAA Aeronautical Ctr, Oklahoma City, ATTN: AAC-44D
2 USA Fld Arty Sch, Ft Sill, ATTN: Library
1 USA Armor Sch, Ft Knox, ATTN: Library
1 USA Armor Sch, Ft Knox, ATTN: ATSB-DI-E
1 USA Armor Sch, Ft Knox, ATTN: ATSB-DT-TP
1 USA Armor Sch, Ft Knox, ATTN: ATSB-CD-AD
2 HQUSACDEC, Ft Ord, ATTN: Library
1 HQUSACDEC, Ft Ord, ATTN: ATEC-EX-E-Hum Factors
2 USAEEC, Ft Benjamin Harrison, ATTN: Library
1 USAPACDC, Ft Benjamin Harrison, ATTN: ATCP-HR
1 USA Comm-Elect Sch, Ft Monmouth, ATTN: ATSN-EA
1 USAEC, Ft Monmouth, ATTN: AMSEL-CT-HDP
1 USAEC, Ft Monmouth, ATTN: AMSEL-PA-P
1 USAEC, Ft Monmouth, ATTN: AMSEL-SI-CB
1 USAEC, Ft Monmouth, ATTN: C, Facl Dev Br
1 USA Materials Sys Anal Agcy, Aberdeen, ATTN: AMXSY-P
1 Edgewood Arsenal, Aberdeen, ATTN: SAREA-BL-H
1 USA Ord Ctr & Sch, Aberdeen, ATTN: ATSL-TEM-C
2 USA Hum Engr Lab, Aberdeen, ATTN: Library/Dir
1 USA Combat Arms Tng Bd, Ft Benning, ATTN: Ad Supervisor
1 USA Infantry Hum Rsch Unit, Ft Benning, ATTN: Chief
1 USA Infantry Bd, Ft Benning, ATTN: STEBC-TE-T
1 USASMA, Ft Bliss, ATTN: ATSS-LRC
1 USA Air Def Sch, Ft Bliss, ATTN: ATSA-CTD-ME
1 USA Air Def Sch, Ft Bliss, ATTN: Tech Lib
1 USA Air Def Bd, Ft Bliss, ATTN: FILES
1 USA Air Def Bd, Ft Bliss, ATTN: STEBD-PO
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Lib
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: ATSW-SE-L
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Ed Advisor
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: DepCdr
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: CCS
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCASA
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCACO-E
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1 Ofc of Naval Rsch, Arlington, ATTN: Code 452
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1 NAVAIRSTA, Norfolk, ATTN: Safety Ctr
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1 Air Force Academy, CO, ATTN: Dept of Bel Scn
5 NavPers & Dev Ctr, San Diego
2 Navy Med Neuropsychiatric Rsch Unit, San Diego
1 Nav Electronic Lab, San Diego, ATTN: Res Lab
1 Nav TrngCen, San Diego, ATTN: Code 9000-Lib
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1 NavPostGraSch, Monterey, ATTN: Code 2124
1 NavTrngEquipCtr, Orlando, ATTN: Tech Lib
1 US Dept of Labor, DC, ATTN: Manpower Admin
1 US Dept of Justice, DC, ATTN: Drug Enforce Admin
1 Nat Bur of Standards, DC, ATTN: Computer Info Section
1 Nat Clearing House for MH-Info, Rockville
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1 C/Air Staff, Royal Canadian AF, ATTN: Pers Std Anal Br
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